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OFFICIAL PUBLICATION OF THE PROCEEDINGS, AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday, by the **HOWES PUBLISHING COMPANY, INC.**, 44 East 23rd Street, New York 10, N. Y. **C. R. Howes**, President; **Ernest J. Finan**, Executive Vice-President; **Norman A. Johnson**, Vice-President & Treasurer; **Myron D. Reeser**, Vice-President; **Clara Patrick**, Secretary.

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AMERICAN
DYESTUFF REPORTER

DEVOTED TO TEXTILE WET-PROCESSING

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AMERICAN

DYESTUFF REPORTER

Volume 49 January 11, 1960 Number 1

SYNTHETIC RESINS FOR CHLORINE-FAST "WASH-AND-WEAR" FINISHES*

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Translated by EVA A PAROLLA and CARL Z DRAVES*

GENERAL DISCUSSION

THE European consumer, as well as his American counterpart, has readily accepted the idea of "easier care" for textiles. As a result, the products that have reached the market under the designation of "wash-and-wear", "no-ironing", "minimum care", etc were soon able to attain considerable importance. In the case of cellulosic fabrics, as is generally known, the no-iron characteristics are achieved by finishing with thermosetting resins. This finishing with synthetic resins largely determines the quality of the end product, although other factors, such as fiber quality, fabric structure, and preparation (kier boiling, bleaching, and mercerizing) may also play an essential part.

The synthetic resins originally used for wash-and-wear finishing were the conventional methylol compounds of urea and melamine in modified or unmodified form. Soon, however, these were replaced to a large extent by the type of methylol compounds that crosslink with cellulose and that had become known under the designation of "reactant resins". The most prominent compound representative of this group is dimethylol ethylene urea. These products are distinguished by their especially high storage stability and liquid state. The fact that the self-linking tendency of these compounds is relatively slight is very characteristic and may possibly be explained by the absence of the highly reactive nitrogen-bound hydrogen atoms of the $-NH.CH_2OH$ group, which causes the methylol groups formed by the addition of formaldehyde to be even more strongly stabilized than they are in dimethylol urea. Another reason might be that the electromeric balance so characteristic of urea is reinforecd by the formation of a five-membered ring. The stability of the methylol linkages might also permit one to draw conclusions, by analogy, regarding the basicity of the amino groups. Thus, the most unstable methylol compounds might be derived from melamine, the most stable from ethylene urea, and those of intermediate stability from urea. Another possibility of stabilizing the methylol consists in etherification of the CH_2OH groups with alcohols. Other methylol compounds that have gained a reputation for stability are the reaction products of dihydroxy ethylene urea and acetylene diurea. The triazone resins, too, may be considered as cyclic urea resins. The nitrogen-free epoxy and acetal resins have more recently attracted attention, without, however, having found large-scale practical application.

The standards of performance demanded of "wash-and-wear" articles are high and varied. Where "no ironing" or "wash-and-wear" is recommended, the crease recovery of such textiles after washing should be so good that they require no pressing or only very slight pressing. In addition, they should dry quickly and should possess high form stability, crease resistance even when dry, and good tensile properties. These performance characteristics should not change essentially during the entire life of the garment, in spite of the fact that cotton goods are washed at the boil in Europe and are often subjected to aftertreatments with solutions of sodium hypochlorite in both Europe and the Americas. The demand that wash-and-wear finishes be fast to chlorine is thus becoming increasingly significant. Some very interesting recent publications (*1, 2, 3, 4*) show how actively the American textile industry is also trying to find a solution to this partially unsolved problem.

The behavior of fabrics finished with nitrogen-containing resins on treatment with solutions of sodium hypochlorite is well known. Two different types of reaction may occur, as follows:

1) RETENTION OF CHLORINE THROUGH CHLORAMINE FORMATION———In this case, the consequences are

a) Fiber damage in the course of subsequent heat treatment
b) Odor of chlorine in the fabrics
c) Yellow coloration in the case of fabrics treated with melamine resins.

2) CLEAVAGE BY OXIDATION OF THE RESINS———This cleavage causes loss of resin and counteracts the effects of the finishing. It can be observed particularly in the case of urea and dicyanodiamide finishes.

The primary and secondary amino groups of the applied resin are responsible for the retention of chlorine. The nitrogen-bound hydrogen atoms are easily replaced by chlorine, resulting in the formation of chloramines according to the following formula:

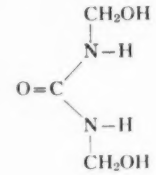
$$\begin{matrix} R \\ R \end{matrix}\!\!>\!NH + HOCl \rightarrow \begin{matrix} R \\ R \end{matrix}\!\!>\!NCl + H_2O$$

Therefore, the fewer imino groups ($>NH$) present in a synthetic-resin precondensate, or the fewer such groups that are liberated during the condensation reaction or subsequent washings, the better the final finish performs with regard to chlorine retention.

*Translated by Eva A Parolla and Carl Z Draves from *Melliand Textilberichte* of March, 1959, with permission of both Chemische Fabrik Pfersee GmbH and the publisher

The following four compounds with methylol linkages are types suitable for finishing: (I) Dimethylol urea, (II) trimethylol melamine, (III) dimethylol ethylene urea or 1,3-dimethylol imidazolidone, and (IV) tetramethylol acetylene diurea, or ureyl glycol. A consideration of these compounds shows that I and II possess imino groups, whereas the nitrogen atoms in the case of III and IV are completely blocked.

1)



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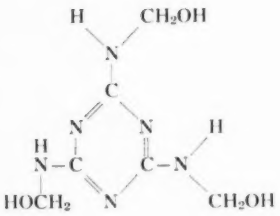

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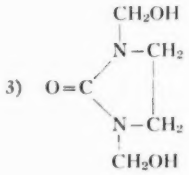

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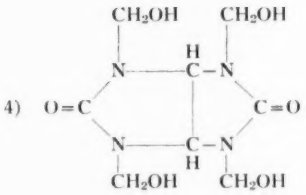
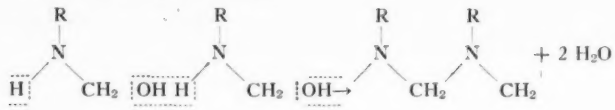
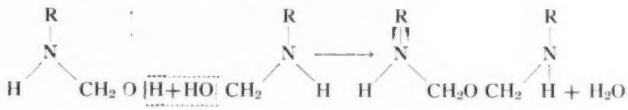


Thus it might be expected that resins based on compounds I and II retain a large amount of chlorine, whereas those based on compounds III and IV are unable to absorb any chlorine. However, since conditions are somewhat more complicated, these conclusions derived from the structural formulas of the methylol compounds correspond only approximately to the actual performance of the polycondensed, hardened resins when treated with chlorine. In the case of the dimethylol urea and trimethylol melamine precondensates, one must consider their possible polycondensation reactions, namely:

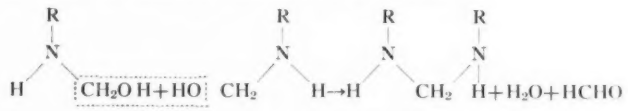
a) Formation of a methylene bridge



b) Formation of an ether bridge



c) Condensation in which formaldehyde is split off



In the predominant reaction, which leads to the formation of methylene bridges ("a"), the imino (>NH) groups are converted into chlorine-insensitive tertiary nitrogens. By reason of the parallel reactions ("a" and "b"), however, the number of remaining imino groups is sufficient to absorb much chlorine. This is well known to happen in the case of fabrics treated with these synthetic resins. Considerably better results are obtained with the modified (alkoxylated) liquid urea and melamine resins; this may be accounted for by the following explanation:

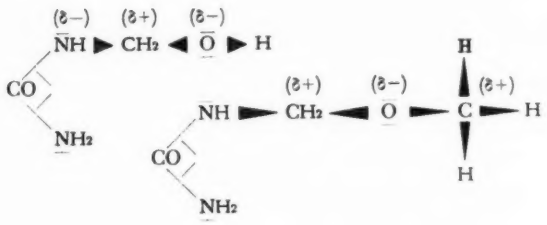
1) An increase in alkoxylation (etherification) is accompanied by a decrease in the basic properties of the precondensate and at the same time, according to Aenishaenslin (5), by a reduced capacity to absorb chlorine. This phenomenon might be explained by a comparison of the structural representations of an unetherified and an etherified methylol linkage. In the unetherified methylol linkage, the proton of the hydroxyl group, by means of an alternating electromeric effect, reinforces the electron configuration of the nitrogen electron pair. The etherified linkage is weakened by an increase in the positive nature of the methyl or other alkyl group.

2) In addition to this attempt at an explanation based on structure formulas, it may be assumed that among the previously shown polycondensation reactions of the modified precondensates the reaction resulting in the formation of methylene bridges ("a") is predominant and blocks a large portion of the >NH groups.

3) A polycondensation almost never results in complete crosslinking; thus, there will always be a remainder of free >NCH$_2$OH groups, and, in the case of modified resins, of >NCH$_2$OR groups (whereby R = alkyl). Whereas the >NCH$_2$OH groups of the unmodified resins are easily converted into >NH groups + formaldehyde during washing or treatment with chlorine, the >NCH$_2$OR groups are quite stable.

In addition to these rules it is important to note that the increased blocking of nitrogen atoms by methylol groups also reduces the capacity to retain chlorine. For instance, dimethylol urea combines with less chlorine than does monomethylol urea or a mixture of mono- and dimethylol urea.

$$-NH\,CH_2\,OH + H\,CHO \rightarrow -N(CH_2OH)_2$$



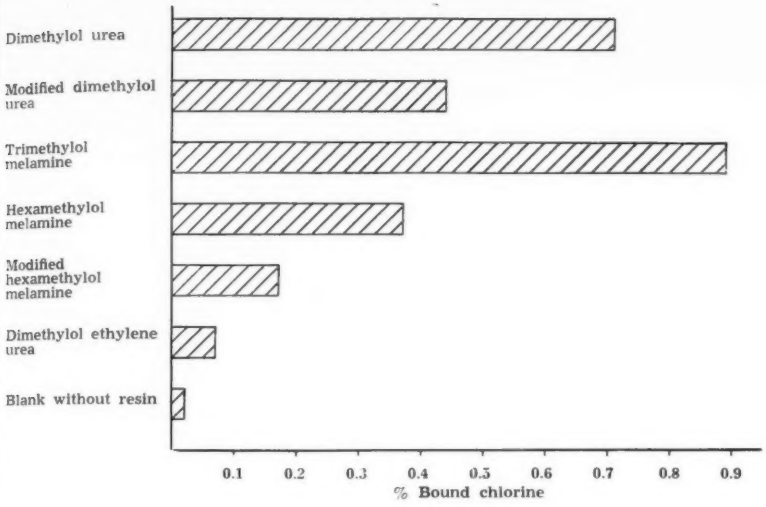


Figure 1

The synthetic resins based on dimethylol ethylene urea, which generally best meet the requirements of wash-and-wear finishing, also compare very favorably with respect to chlorine retention with the other types of synthetic resins described above. However, even the dimethylol ethylene urea type of synthetic resins cannot be said to be completely inert when treated with chlorine, ie, unable to retain any chlorine, as might be expected because of the absence of >NH groups in the molecule. As will be explained in greater detail later on, the hydrolysis, or splitting off, of formaldehyde is responsible for the ability of the resins to retain some chlorine. The following formula illustrates this reaction.

$$>N\,CH_2OH \rightarrow >NH + HCHO$$

The splitting off of formaldehyde, accompanied by the liberation of an >NH group, may occur during the condensation process, later on in the course of steaming operations, or finally during washing.

Only the epoxy and acetal resins, which are free from nitrogen, absorb almost no chlorine. However, these resins have hardly passed the experimental stage.

Figure 1 shows the relative amounts of chlorine absorbed by cotton fabrics treated with the various types of synthetic resins previously described. The chlorine treatment followed an AATCC method (2.5 gram/liter of active chlorine, at 27°C, or approximately 81°F, pH 11, 15 minutes). The active chlorine retained in the fabric was determined by the usual iodometric procedure.

Chlorine retention merits special attention because of the danger of fiber damage. When a fabric containing bound chlorine is subjected to heat treatment, such as drying, ironing, mangling, or calendering, a considerable loss in strength, brown discoloration, and even complete destruction may result. These phenomena, which may be characterized as damage by chlorine, are probably caused by the hydrolytic degradation of cellulose, for which the hydrochloric acid formed from chloramine at elevated temperatures is responsible. The atomic oxygen liberated during the hydrolysis of the chloramine may also be a factor contributing to fiber damage.

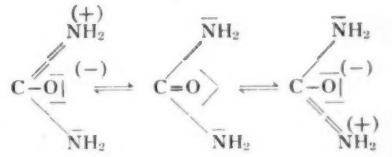
$$>NCl + H_2O \rightarrow >NH + HCl + O$$

Cotton is more easily damaged by chlorine than are the regenerated-cellulose fibers, because cotton is more susceptible to hydrolytic deterioration. This fact has already given rise to many theories. This difference may be caused, on the one hand, by the entirely different density of packing of the fibers, or, on the other hand, by the difference in average degree of polymerization of the cellulose molecules. It could be that the splitting of molecules containing long chains is of much greater influence on fiber strength than is the splitting of macromolecules containing shorter chains.

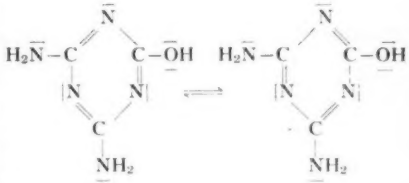
According to Nuessle (*1*), whose conclusions are in complete agreement with our results, the extent of damage by retained chlorine during ironing is not proportional to the amount of chlorine in the fabric, as determined by analysis. Rather, two factors other than analytically determined chlorine in the fabric are decisive for the extent of chlorine degradation, viz, the buffering power of the resin and, of course, the ironing temperature. Nuessle expresses this mathematically by means of the following equation:

$$\text{chlorine deterioration} = f\left(\frac{\text{chlorine retention, ironing temperature}}{\text{buffering power}}\right)$$

According to this equation, chlorine degradation increases with an increase in chlorine retention and ironing temperature and decreases with increased buffering power of the resin. This so-called buffering power of the resin is a function of the basicity of the amino groups present in the molecule. As was briefly mentioned in the beginning, the structure of the molecule determines to a great extent whether or not the amino groups act like a base. Thus, the basic quality of the amino groups depends on the lone electron pair of the nitrogen atom, which (inasmuch as it is not directed towards the interior of the molecule by an electromeric equilibrium) possesses strong prototropic properties and is readily capable of forming a bond with hydrogen ions. Where, however, the entire molecule is mesomeric in character, as in the case of urea, the formation of the oxygen double bond is accompanied by the participation of the lone electron pair in the electron shell of the total molecule. The stronger this participation, the weaker prove to be the prototropic properties of the electron pair.

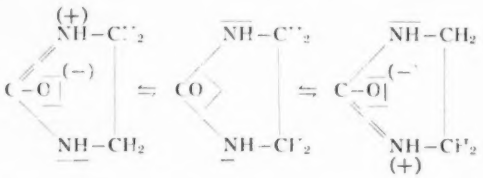


In this case the amino group does not react like a base, or only weakly so. If we compare with this the formula of, eg, ammeline (4,6-diamino-s-triazin-2-ol),



it may be seen that the electromeric exchange takes place only between the inner, tertiary nitrogen atoms. In view of the favorable arrangement of a 6-membered ring, the double bonds of the triazine

ring are probably in a state of total equilibrium resembling that of benzene. The individual nitrogen pairs of the nitrogen are conjugated and have little possibility among themselves to enter into the electromeric equilibrium. The nitrogen atoms of this combining group are therefore decidedly basic in character. However, anyone considering the formula of ethylene urea will immediately be aware of the analogy with the urea molecule, whereby the inner resonance of the molecule is probably reinforced rather than weakened by the 5-membered ring. In this case the nitrogen groups also appear to exist in a state of relatively less buffering capacity. The best way to grasp this situation is to compare the structural formulas of the three nitrogen-containing compounds under discussion.



As may be seen, contemplation of the structural formulas is sufficient to conclude that the different nitrogen compounds possess different degrees of basicity, ie, reactivity with split-off acid. The aminotriazine compounds that have hitherto been commercially available had favorable as well as unfavorable characteristics with respect to retention of chlorine: Unfavorable, inasmuch as the aminotriazines (ie, melamine resins) have a great tendency to absorb or retain chlorine; favorable, however, inasmuch as their basicity prevents major damage by ironing.

As noted above, the decisive difference between the former and present methods of determining chlorine retention is that, formerly an assay was made of the quantity of fiber-bound chlorine, whereas, at present, the buffering properties of the resins and the chlorine degradation dependent on these properties must also be taken into consideration. In the evaluation of a wash-and-wear finish it is therefore no longer sufficient to confine oneself to an analysis of the bound chlorine. The AATCC scorch test is a method that is excellently suited to practical conditions and that takes into account the probability of chlorine degradation in the course of the heat treatments described below.

Since ethylene urea resins are most frequently employed nowadays for the wash-and-wear or no-iron finishing of cotton, particular attention will be paid here to this type of resin. Fabrics finished with these synthetic resins, as may also be seen from Figure 1, possess at first a very low degree of chlorine retention. The amount of bound chlorine lies under the critical level, so that subsequent ironing at the usual temperatures ranging from 180 to 220°C (356 to 428°F) need not cause one to fear any noteworthy damage by chlorine.

Far more unfavorable results may be envisaged, however, when it is considered that the goods, in actual use, have in most instances already been subjected to several washings at the boil prior to their treatment with solutions containing hypochlorite. Five washings at the boil, for example, increase two- to three-fold the chlorine absorptivity of an ethylene urea-resin finish. The resulting capacity for chlorine retention far exceeds the critical level for this type of synthetic resin, so that subsequent heat treatments produce fiber damage and brown discoloration. The washings at the boil evidently cause a loosening of the resin structure, whereby further $>NCH_2OH$ groups, not crosslinked with cellulose, are exposed and become converted into reactive $>NH$ groups by the splitting off of formaldehyde. This loosening process does not undo practically any of the effects of the finishing. This somewhat paradoxical situation may perhaps be caused by the fact that the presence of the dimethylol ethylene urea molecules results, in addition to the mere formation of individual molecular bridges between the hydroxyl groups of the cellulose (such as, for example, the methylene bridges obtained from treatment with formaldehyde), in the building in of relatively small molecular aggregates. The negligible degree of linear self-linking, which thus also appears to occur, is significant inasmuch as bridges formed by more than a single dimethylol ethylene urea molecule are probably more elastic than are methylene bridges possessing a single linkage or three-dimensional crosslinking aggregates, respectively. It is generally very difficult to distinguish strictly between self-linking and fiber-linking synthetic resins. Only a relatively accurate quantitative investigation would establish the respective percentages of the self-linking and the fiber-linking constituents. Thus, the so-called self-linking synthetic resins will also form occasional fiber linkages, whereas the so-called fiber-linking resins will also be found to self-link to some extent. In any case, it is definitely feasible that alkaline washings result in the partial cleavage of the small molecular aggregates that block the hydroxyl groups, without essentially changing the blocking of these groups. This might serve to explain the fact that a loosening of the resin structure may take place without impairing the effects of finishing. It is questionable if a partial opening of the ethylene urea ring by hydrolysis takes place under severe washing conditions, as assumed by Borghetty (*6*).

The unfavorable properties of the ethylene urea resins with respect to chlorination after alkaline washings are closely connected with their good fastness to washing at the boil. The resins not fast to washing, especially the carbamide resins, do not show a deterioration after washing with respect to their initial degree of chlorine retention—mostly they even show improvement—because they are partially washed out. Consequently, the effects of an ethylene urea finish are hardly distinguishable from those of a simple urea finish after several washings at the boil. This aspect makes it imperative to modify the washfast ethylene urea resin in such a way that it will no longer cause any damage after ten to twenty washings. These conclusions are significant because the use of ethylene urea-resin finishes, under test conditions corresponding to conditions of actual use, may result in considerable damage from chlorine degradation. The finisher is thus faced with the important question as to whether nowadays there is any type of synthetic resin available at all which would make it possible to obtain wash-and-wear finishes that are fast to chlorine and, also, what would be the most suitable conditions for obtaining such finishes. If one disregards the nitrogen-free resins (such as the epoxy and acetal resins), which have not yet been properly evaluated with respect to techniques of application, the answer to these questions lies in the results of our development work and investigations, which are stated and discussed in the following pages.

EXPERIMENTAL WORK

Our first task was to find a compound which, by reason of its composition, would permit the liberation, during the hot process of ironing and the resulting hydrolysis of the chlor-

amine, of a number of basic groups sufficient to buffer any hydrochloric acid formed. On the other hand, the basic groups of this compound should be inactivated after the formation of the resin in such a way that chlorine-binding properties do not become evident under normal conditions. The difficulty of developing such a compound lay in finding a resin precondensate that did not exceed the degree of analytical chlorine retention of the ordinary dimethylol ethylene urea but which, on the other hand—under conditions of hydrolysis brought about by ironing—allowed the formation of buffering groups for the neutralization of hydrochloric acid. The condensation of a certain triazine compound with a dimethylol ethylene urea base provided the solution to this problem, also with respect to the other properties of the resulting product: for, in addition to maintaining good chlorine retention, it was also necessary to preserve the other favorable characteristics of the ethylene urea resin, eg, good fastness of cotton to washing at the boil.

In order to confirm and explain this work in the framework of this publication, we have examined the relationship between chlorine fastness and the following factors:

1) TYPE OF SYNTHETIC RESIN
2) TYPE OF CATALYST
3) INTENSITY OF CONDENSATION
4) NUMBER OF WASHINGS AND TYPE OF CHLORINE TREATMENTS.

The conditions for these laboratory tests were chosen so as to correspond as far as possible to conditions of actual use. For these experiments we have employed a mercerized, bleached cotton poplin with the following properties:

Wt per sq meter: 124g
Count:
Warp, 47 per cm, 119 per in
Filling, 24 per cm, 61 per in

The synthetic-resin precondensates were applied at a concentration of 80 g/l active ingredient, or 10.7 oz per Am gal (eg, 160 g/l of a 50% commercial product). Magnesium chloride served as the catalyst (except for the series of tests in which the influence of different catalysts was examined); the initial charge contained 20 g/l, or 2.67 oz per Am gal, of magnesium chloride hexahydrate.

The synthetic-resin treatment took place on a two-roll laboratory padder. The pickup was 70%. The padded samples were stretched on a frame of the proper size and predried in a drying oven with air circulation at a temperature of 100°C (212°F).

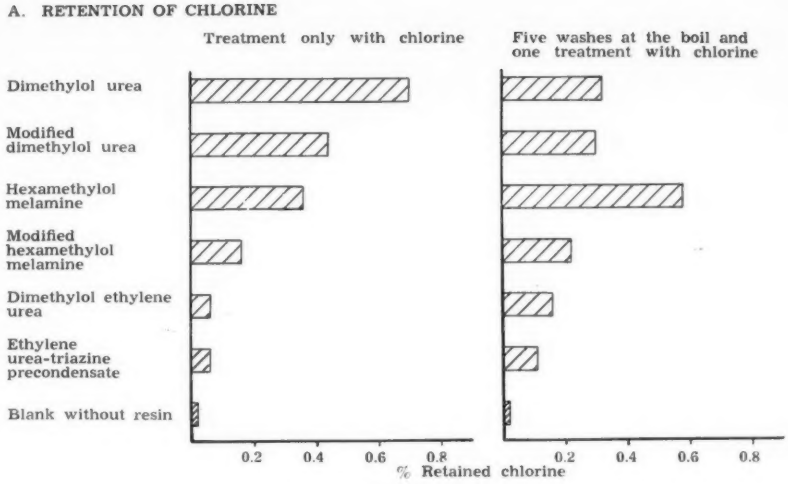


Figure 2

They were then cured for four minutes at a temperature—unless otherwise indicated—of 150°C (302°F). Washing and other tests were undertaken after the samples had lain spread out for ten days. Washing tests were carried out at the boil in a drum washer as follows:

soap: 3 g/l, or 0.4 oz/gal
soda ash: 2 g/l, or 0.27 oz/gal
laquor ratio: 50:1
water softened to about 179 ppm (or 10° DH)
20 minutes at 95°C (203°F)
two lukewarm and two cold rinses
air-drying

The treatment with chlorine was carried out in the same washing machine according to the following AATCC procedure:

2.5 g/l active chlorine
liquor ratio: 30:1
pH 11, 27°C (approx 81°F), 15 min
six rinses
air-drying

In order to obtain a comprehensive picture of the fastness to chlorine we have individually examined the following factors:

A) Chlorine retention
B) Brown discoloration on ironing
C) Chlorine damage
D) Crease reduction

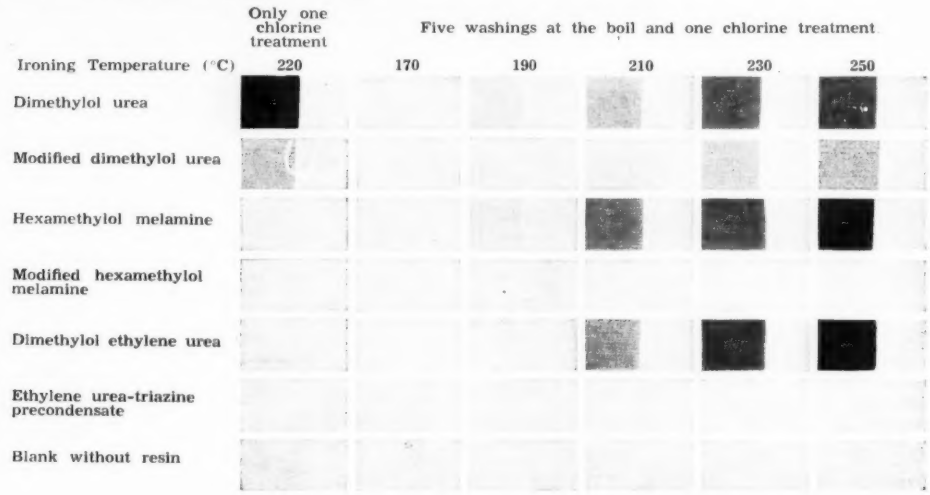
A) CHLORINE RETENTION—The amount of bound chlorine retained on the fabric after the chlorine treatment and six rinses was determined iodometrically.

B) BROWN DISCOLORATION ON IRONING———Tests were made to determine if and to what extent a 30-second ironing at 220°C (428°F) causes a brown discoloration of the finished, chlorinated fabrics. The pressure in ironing amounted to 28 g/cm². The temperature of the iron was measured with an exactly standardized surface pyrometer. Only narrow, 2-cm strips of fabric were ironed. This procedure made it possible to subject a whole series to the ironing treatment at one time in order to obtain comparable results. The evaluation of browning was visual.

C) CHLORINE DAMAGE—Chlorine damage is expressed in percent loss of tensile strength caused by heat treatment of the chlorine-treated fabrics. In the United States the Scorch Tester (AATCC) is used for this heat treatment. Samples like those cut for the breaking test are pressed between the two metal plates of the Scorch Tester in the American test at exactly 185°C (365°F) at a definite pressure for thirty seconds. Since the Scorch Tester was not available to us (in Europe), we have used a flatiron. In order to compensate somewhat for the difference between a flatiron and a Scorch Tester —in the case of the latter, two metal plates (as already mentioned) act on the fabric—we have ironed the samples for thirty seconds at a temperature of 200°C (392°F) instead of 185°C (365°F). The ironing pressure was again 28 g/cm². The tests for breaking strength were carried out in both warp and filling direction before as well as after the chlorine treatment and ironing (Schopper breaking tester).

D) CREASE REDUCTION——— The reduction in crease angle produced by chlorine and wash treatments was determined. Dry crease angles were tested by the DIN (German Industrial Standards) Method 53 890; wet crease angles, by the Guet V Method.

B. BROWN DISCOLORATION ON IRONING



(Catalyst: $MgCl_2$; Condensation: four min at 150°C)

Figure 3

C. CHLORINE DAMAGE

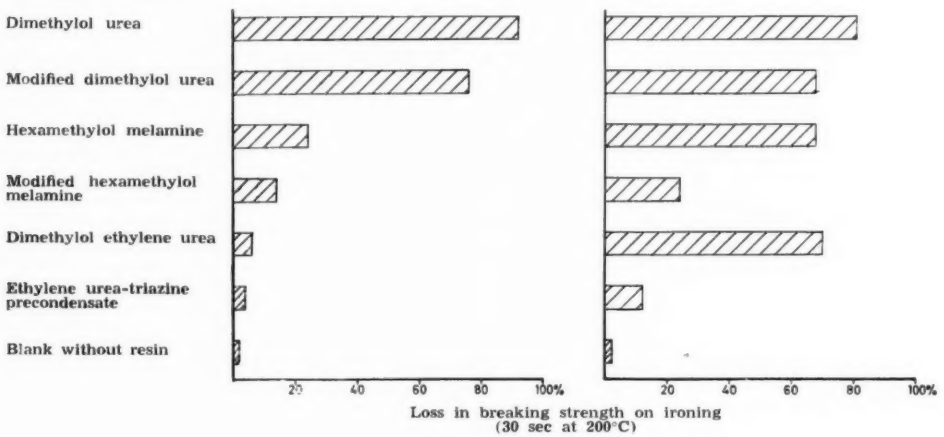


Figure 4

D. CREASE ANGLE

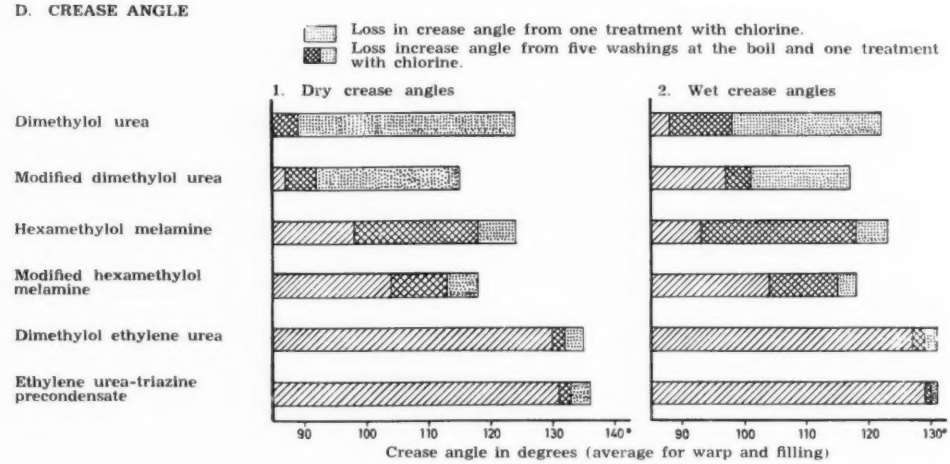


Figure 5

EFFECT OF RESIN TYPE ON CHLORINE FASTNESS

As was already demonstrated in theory, the type of synthetic resin used is an essential factor in chlorine retention. Thus, in addition to the carbamide, melamine, and ethylene urea precondensates described in the beginning of this article, the above-described, newly developed ethylene urea-triazine precondensate was tested for fastness to chlorine. A part of the cut fabric samples finished with these types of synthetic resin was treated only with chlorine, another part was washed five times at the boil and then treated with chlorine. Finally, all the samples were subjected to the proper tests. The test for brown discoloration on ironing was carried out in order to determine the influence of ironing temperatures of 170, 190, 210, 230, and 250°C (338, 374, 410, 446, and 482°F). The results are summarized in Figures 2 to 5. For greater clarity the degree of chlorine retention, chlorine damage, and decrease in crease angle are presented graphically, whereas the results of the ironing tests are reproduced photographically.

Although a study of Figures 2 to 5 shows many relationships, we should like to confine ourselves to a discussion of those results that seem important to us. In those instances where the test for chlorine fastness consisted solely in treatment with chlorine without prior washing, the resins based on modified hexamethylol melamine compounds, dimethylol ethylene urea, and ethylene urea-triazine performed very well inded. Chlorine retention and chlorine damage were negligible, no brown or yellow discoloration occurred during ironing, and crease resistance remained practically unchanged. However, when the fabrics were washed five times at the boil prior to treatment with chlorine, the chlorine absorptivity of particularly those types of resin that are normally washfast was considerably increased, whereas it was somewhat diminished in the case of the carbamide resins because of the great loss in resin. When the resin possessed only a very low buffering power, the increased chlorine absorptivity had a particularly strong effect on chlorine damage and on the brown discoloration resulting from ironing. We have already attempted to give the reasons for this behavior in the brief theoretical explanation. As may further be deduced from Figures 2 to 5, modified hexamethylol melamine also possesses good buffering capacity, which is readily understandable in accordance with our explanations, because of the high basicity of this compound. However, this product has the disadvantage that its capacity for chlorine retention is simply too high, as is the case with all melamine resins, and that it does not possess satisfactory stability to washing at the boil. Furthermore, the initial crease recovery angles on cotton are not always quite adequate to meet the increasingly higher standards demanded by the consumer for wash-and-wear finishing. The best results are obtained with the ethylene urea-triazine precondensate. In the first place, this type of resin combines with only very small amounts of chlorine, as do the ethylene urea products in general; contrary to the latter, however, it is so highly basic that it can counteract the increase in chlorine retention produced by successive washes at the boil. As a consequence, it is subject neither to brown discoloration on ironing nor to any essential chlorine damage.

A comparison of Figure 2 with Figures 3 and 4 shows that neither the damage by chlorine nor the brown discoloration on ironing were exactly proportional to the retention of chlorine. The amount of bound chlorine is therefore no measure of the degree of chlorine damage or of the intensity of the brown discoloration that may be expected on ironing. A similar situation obtains in the titrimetric examination of the precondensate solution. Thus, Nuessle (*1*) in his publication (p 468, Figure 3) shows three titration curves for various resins and reactants. The curves demonstrate the displacements in pH on the addition of 0.1 N hydrochloric acid to a 10% resin solution. We have used the same method to establish curves for various resins and have found that the results reflect solely the basicity of the precondensate. Since hydrolysis on ironing, however, may also liberate potentially basic groups, which are not yet evident during a cold titration prior to resinification, these curves do not accurately measure the propensity of a resin to cause chlorine damage. Thus, our investigations of various products have even turned up cases where, for instance, the titration curves were inversely proportional to the results of the hydrolysis obtained on ironing. On the other hand, chlorine damage and brown discoloration on ironing are usually parallel. It is therefore possible, if there happens to be no time for determining chlorine damage, to estimate chlorine damage from the degree of brown discoloration produced upon ironing. It must merely be realized, however, that chlorine damage sets in at a somewhat lower ironing temperature than does the brown discoloration.

The various types of synthetic resin react very differently with respect to the reduction in crease angle resulting from treatment with chlorine. This reduction reflects the oxidative or hydrolytic cleavage of the resin that results from treatment with chlorine and is especially great in the case of the carbamide resins. Melamine-resin finishes suffer a considerably greater reduction in crease angle from washings at the boil than from chlorine treatment and are superior to urea resins also with respect to stability to wet processing. Finishes based on the dimethylol ethylene urea and the ethylene urea-triazine reactive types retain crease resistance almost completely after chlorine treatments as well as after washings at the boil. In addition, it may be noted that this behavior is practically the same in the case of dry as well as wet crease angles. As a result we felt justified in confining ourselves further to the evaluation of only the dry crease angles.

EFFECT OF TYPE OF CATALYST

With respect to these two reactant types we have tested the effect of the following catalysts on fastness to chlorine:

Ammonium chloride, diammonium phosphate, morpholine hydrochloride, zinc and magnesium chloride.

The determinations were made after five washings at the boil and one treatment with chlorine. The results are summarized in Figures 6 to 8.

From Figure 6 it may be inferred that chlorine retention depends but little on the type of catalyst used. The catalyst is nevertheless a decisive factor with respect to chlorine damage and brown discoloration on ironing (Figures 7 and 8). Whereas the most unfavorable results are obtained with ammonium salt-type catalysts, especially the diammonium phosphate, and the most favorable with metal-salt catalysts, an intermediate position is occupied by morpholine hydrochloride. From a careful comparison of the two metal-salt catalysts it appears that zinc chloride tends to be even somewhat more advantageous in this application than magnesium chloride. On the other hand, zinc chloride is known to have some disadvantages, such as exerting a fairly strong precipitating action on certain softeners, optical brighteners, and other possible additives, and precipitating as zinc chloride itself when the finishing bath is not acidified to a pH

A. CHLORINE RETENTION

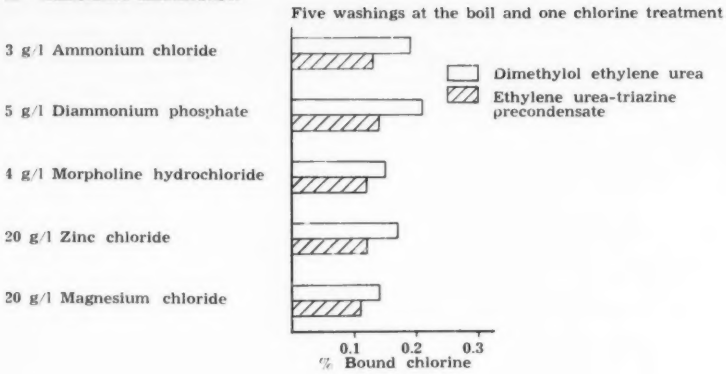
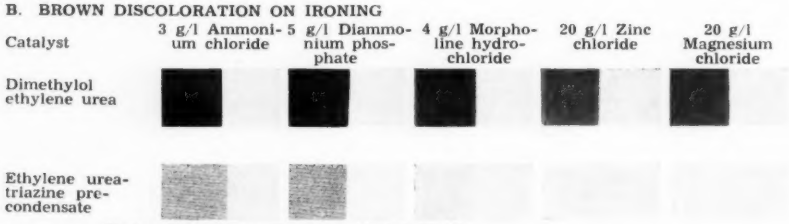


Figure 6

B. BROWN DISCOLORATION ON IRONING



Curing Conditions: four min, 150°C (302°F)
Aftertreatment: five washings at the boil and one chlorine treatment
Ironing Temperature: 220°C (428°F)

Figure 7

C. CHLORINE DAMAGE

D. CREASE ANGLE (DRY)

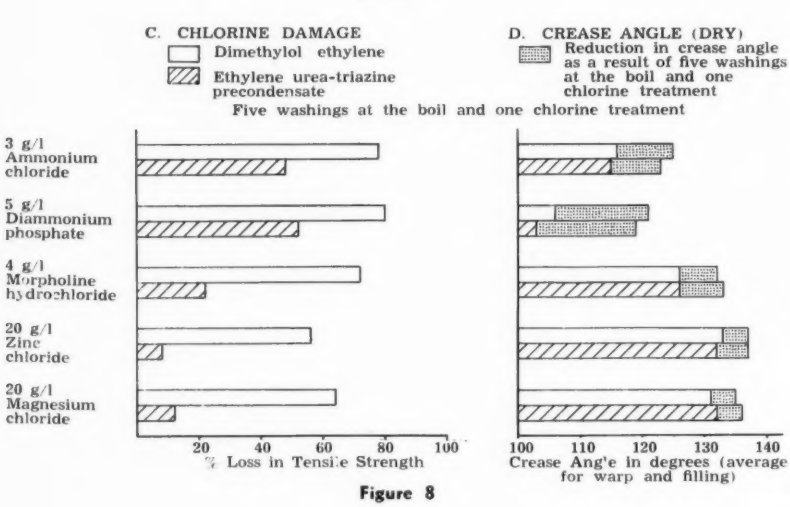


Figure 8

value of 5.5-5.6. Bacon *et al* (4) report that zinc nitrate is a catalyst well suited to the elimination of chlorine retention. However, they concede that condensation with zinc nitrate produces distinct yellowing. In order to achieve better results during condensation, they then go on to suggest the use of magnesium chloride. Research in our laboratories has shown that zinc chloride, as was briefly mentioned before, also gives very good results. In the case of the zinc nitrate, the brown discoloration during condensation may well be caused by the oxidizing effect of nitration.

The relatively more advantageous effect of the metal-salt catalysts in regard to chlorine damage and brown discoloration on ironing may be explained by the assumption that traces of metal hydroxides from alkaline washings are left on the fabric and exert a buffering effect. However, this explanation is not quite satisfactory. Thus, we have not succeeded in finding even traces of the magnesium catalyst on the fabric after five washings at the boil. On the other hand, the more favorable effect with regard to chlorine damage of magnesium chloride when compared with ammonium salts is still fully evident after even twenty washings at the boil. It may therefore be assumed that the metal-salt catalysts are also responsible for effecting a stronger, more complete linkage of the reactant resins with the OH groups of the cellulose. This is also borne out by the minimum reduction in crease angle (Figure 8) resulting from washing at the boil and chlorine treatment after the use of magnesium or zinc chloride as catalysts. Of the catalysts tested, diammonium phosphate behaved least favorably in general and also with respect to crease resistance. The strange fact that metal-salt catalysts are more advantageous in regard to brown discoloration on ironing might also be explained by the circumstance that the nitrogen-containing catalysts on reaction with formaldehyde liberate their entire residual acid, which develops a very low pH value on the fiber during drying. These acid ions could combine with the basic groups of the resins that are used and thereby considerably lower the acid-combining capacity of the latter. If hydrolysis on ironing should subsequently cause the chloramine to liberate additional acid, the buffering protection would thus have become partially ineffective. A comparison of the graphs shows that especially the new ethylene urea-triazine resin manifested the greatest differences in its behavior with different catalysts. This phenomenon might be explained by the assumption that the amino groups of basic resins, besides forming chloramines, may also have the capacity of combining with chlorine-containing ions to form salts, ie, both hydrochlorides and hydrohypochlorites.

$$>\!NH + H^+Cl^- \longrightarrow \left.\begin{matrix}>\!NH \\ \downarrow \\ H\end{matrix}\right\}^+ Cl^-$$

$$>\!NH + H^+ClO^- \longrightarrow \left.\begin{matrix}>\!NH \\ \downarrow \\ H\end{matrix}\right\}^+ ClO^-$$

If a more careful study is made of the behavior of the ammonium salt, the organic-nitrogen salt, and the metal salt as catalysts, it is found that their performance characteristics may be arranged in a certain order. This permits of another possible explanation. The reaction of nitrogen catalysts with formaldehyde leads to the formation of additional cyclic nitrogen compounds, such as, for example, hexamethylene tetramine. The condensation or cleavage of these cyclic compounds might increase the total amount of basic nitrogen atoms present in the resin, so that here again an increase in chlorine retention is made possible. Observations made by Wannow (7) as well as others indi-

cate the unfavorable influence of DMEU (dimethylol ethylene urea), in comparison with carbamide resins, on the lightfastness of substantive dyeings. More recent investigations in our laboratories have shown clearly that the use of metal-salt, especially zinc-salt, catalysts brings about a considerable improvement with respect to lightfastness. At the same time there is added protection against the possible formation of trimethylamine compounds. The first attempts at comparing the new ethylene urea-triazine mixed condensate with the older cyclic compounds showed that the new condensate has a greater effect in improving the lightfastness of various light-sensitive dyes.

There can be no doubt that chlorine fastness is influenced not only by the type but also by the amount of catalyst used. If the amount is too small, inadequate crosslinking and hardening result, and the fastness to chlorine is less satisfactory. A minimum quantity must therefore be employed, which, in the case of magnesium chloride hexahydrate, may amount to 10-12% on the weight of a 50% synthetic-resin product. It does not seem to do much good to exceed this minimum quantity substantially, since such excess does not produce a further improvement in chlorine fastness. The amounts of catalyst are thus determined by their effectiveness on the crosslinking reaction of the resin with the fiber. Additives frequently used in the synthetic-resin liquor, such as water repellents, softeners, and weighting finishing agents, may also have a substantial influence on the fastness to chlorine. Some of these additives contain substances having amino, imino, amido, or imido groups, all of which may tend to increase the chlorine-retention capacity of the finished fabrics. It is therefore advisable to investigate the additives for use in wash-and-wear finishing with regard to this possibility.

EFFECT OF INTENSITY OF CONDENSATION (OR CURE)

It seemed interesting to examine if and to what extent the fastness to chlorine of fabrics finished with reactant resins depends on the intensity of condensation. We have therefore treated samples of cotton poplin with the following two synthetic-resin solutions:

1) 80 g/l dimethylol ethylene urea (160 g/l of the 50%-active commercial product) and 20 g/l magnesium chloride;
2) 80 g/l ethylene urea-triazine precondensate (140 g/l of the 57%-active commercial product) and 20 g/l magnesium chloride.

A. CHLORINE RETENTION

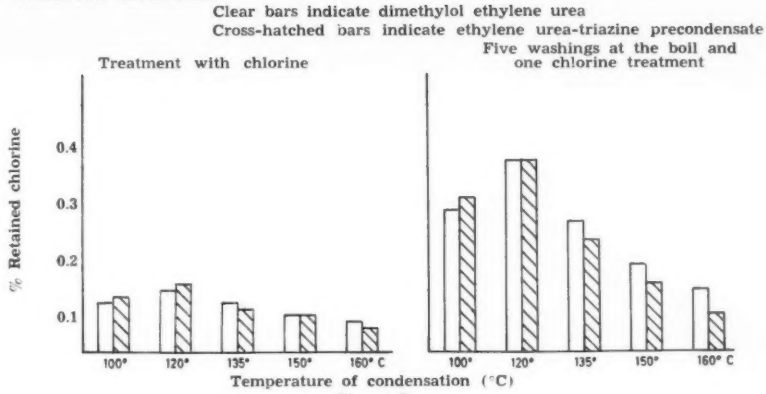


Figure 9

B. BROWN DISCOLORATION ON IRONING

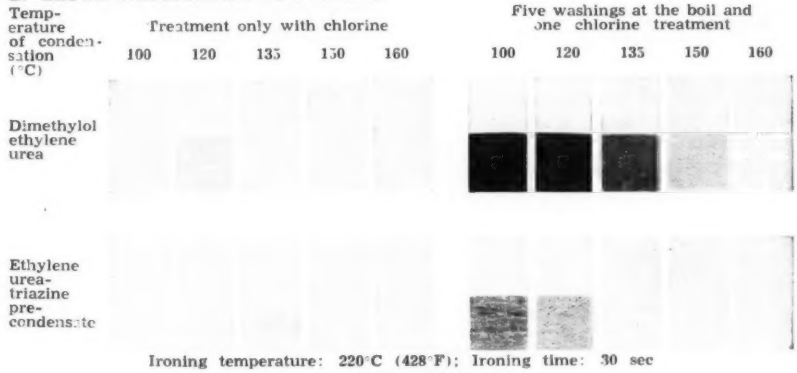

Temperature of condensation (°C)
Treatment only with chlorine
Five washings at the boil and one chlorine treatment
100 120 135 150 160
100 120 135 150 160
Dimethylol ethylene urea
Ethylene urea-triazine pre-condensate
Ironing temperature: 220°C (428°F); Ironing time: 30 sec

Figure 10

C. CHLORINE DAMAGE

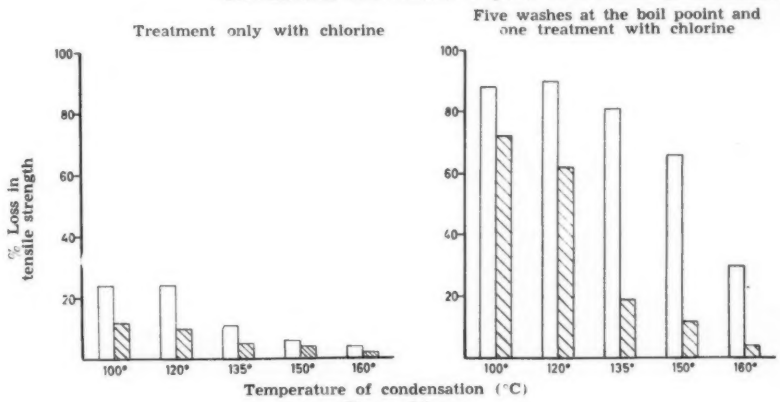


Figure 11

After preliminary drying, the treated samples were cured for four minutes at increasing temperatures: namely, at 100, 120, 135, and 160°C (212, 248, 275, and 320°F). Care was taken to vary only the temperature of condensation, whereas the other factors determining intensity of condensation, such as duration, type of condensation (drying with hot air), and air velocity were kept constant.

In order to establish the effect of washings in this connection, we have carried out our tests once after one treatment with chlorine and the other time after five washings at the boil and one treatment with chlorine.

Figures 9 to 12 show clearly that the temperature of condensation influences substantially the chlorine fast-

ness of fabrics treated with reactant resins. This influence is relatively less evident if the test is carried out after only one chlorine treatment with prior washing. However, if the test is made after five washings at the boil and one chlorine treatment, the temperature of condensation is definitely decisive for the retention of chlorine, as well as for brown discoloration on ironing and chlorine damage. As the temperature increases, the capacity for chlorine retention, the tendency to brown on ironing, and chlorine damage decrease. This phenomenon again may be explained by the fact that a high temperature of condensation effects a relatively more complete, firmer cross-linkage of the resin and a reduction in the amount of unreacted >NCH$_2$-OH groups. As a result, the points of attack available during washing and treatment with chlorine are substantially dimished, and the loosening of the resin by washing, accompanied by the liberation of chlorine-sensitive >NH groups, is possible in only a much more limited degree.

It may be observed that the behavior of both of these resins depends on the condensation, yet here again the ethylene urea-triazine precondensate performs considerably better in all instances than does the usual dimethylol ethylene urea with respect to chlorine damage and brown discoloration on ironing. As may further be deduced from Figures 10 and 11, the usual ethylene urea resins are definitely suitable for the production of wash-and-wear finishes that are fast to chlorine. However, this requires a condensation time of at least four minutes at a temperature of 160° (320°F), which, so far as it is achieved in practice, is known to affect the breaking strength adversely. On the other hand, use of the ethylene urea-triazine resin produces good chlorine fastness at the ordinary condensation temperature of 140°C (248°F).

This possibility of reducing the temperature is very noteworthy and has great practical significance, since it is not easy in actual practice really to reach a required temperature of condensation of at least 160°C (320° F). Bacon *et al* (*4*) even specify a temperature of 176°C (350°F) if subsequent chlorine damage is to be eliminated. To prevent the previously mentioned yellowing effect of the zinc nitrate catalyst, they suggest a temperature of 160°C (320°F). They state, however, that a temperature of 190°C (375°F) is best for obtaining a minimum of chlorine retention, yet declare that considerations of breaking strength here again make preferable

D. CREASE ANGLE (dry)

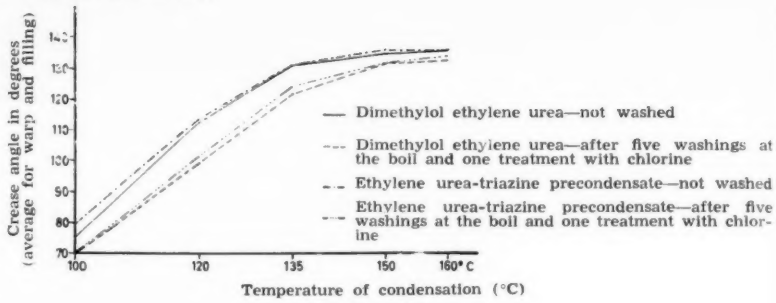


Figure 12

a temperature of 163°C (325°F). In our opinion, all these temperatures are extremely high and, even in the presence of metal-salt catalysts, cause considerable losses in breaking strength. If one considers further that these are fabric temperatures, he can imagine the strain they produce on the curing range in a finishing plant. On the other hand, there is the demand for economy and increased production. The lower the fabric temperatures required for finishing, the higher is the production that may be expected. In addition, many plants suffer from a lack of space, so that it is very difficult to install large curing ranges. For such plants the possibility of reducing the curing temperatures to 140-150°C (284°-302°F) will also be very welcome. Furthermore it is known that negligible differences in steam pressure, differences in the weight of the goods to be finished, and possibly also small differences in pickup may cause variations in drying, in spite of the best possible supervision, and may lead to variations in the condensation. The lower the condensation point that may be established, the greater is the probability that, even in the case of fluctuations, an unobjectionable finish may still be guaranteed. Thus, in addition to improved tensile strength, the use of lower temperatures also assures significantly better control of production. Practical experience has already shown, for example, that the new-type ethylene urea-triazine precondensates give satisfactory scorch tests after only one condensation of four minutes at 150°C (302°F), whereas the usual ethylene urea resins produced unsatisfactory chlorine fastness even after two condensations under similar conditions. It may generally be said that the disadvantage of the current ethylene urea compounds has been less noticeable in the laboratory than in the finishing plant. Another advantage of the new ethylene urea-triazine resins is the possibility of using zinc salts as catalysts, since condensation at 140-150°C (284-302°F) produces neither fiber damage nor brown discoloration. Furthermore, the new resins make it possible to take advantage of the better light-fastness properties that result from the use of zinc salts. Finally, it may be pointed out that the reduction in curing temperature also improves the possibility of formulating conventional paraffin-containing water repellents and softeners with the resin finish, as too high curing temperatures may lead to the volatilization of these compounds. It is generally known that very high temperatures in the presence of excess formaldehyde favor the formation of trimethylamine. In this respect also the reduction of the temperature of condensation by 20°C (36°F)has a decidedly advantageous effect.

The graph in Figure 12 illustrates the effect of the temperature of condensation on the crease angle before and after five washings at the boil and one chlorine treatment. It may be concluded in particular from this curve that two types of reactant resins tested behave identically with respect to crease angle. The reduction in crease angle produced by washings at the boil and treatment with chlorine was also equally small in the case of both resins, especially when the condensation was carried out at elevated temperatures.

NUMBER OF WASHINGS AT THE BOIL AND TYPE OF CHLORINE TREATMENTS

The preceding experiments have already established the fact that washings at the boil strongly affect the chlorine retentivity of cotton fabrics treated with dimethylol ethylene urea, and especially their tendency to suffer chlorine damage and brown discoloration on ironing. In order to learn to what extent the number of washings at the boil and the type of

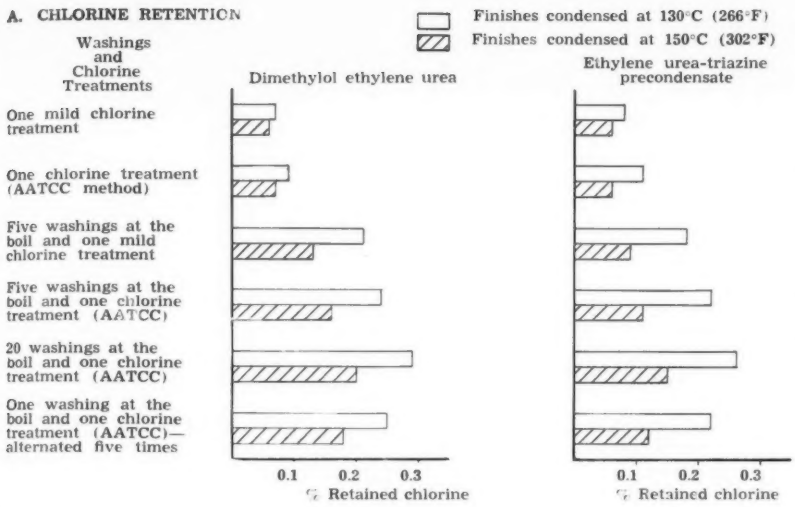

A. CHLORINE RETENTION
Finishes condensed at 130°C (266°F)
Finishes condensed at 150°C (302°F)
Washings and Chlorine Treatments
Dimethylol ethylene urea
Ethylene urea-triazine precondensate
One mild chlorine treatment
One chlorine treatment (AATCC method)
Five washings at the boil and one mild chlorine treatment
Five washings at the boil and one chlorine treatment (AATCC)
20 washings at the boil and one chlorine treatment (AATCC)
One washing at the boil and one chlorine treatment (AATCC)—alternated five times
0.1
0.2
0.3
% Retained chlorine
0.1
0.2
0.3
% Retained chlorine

Figure 13

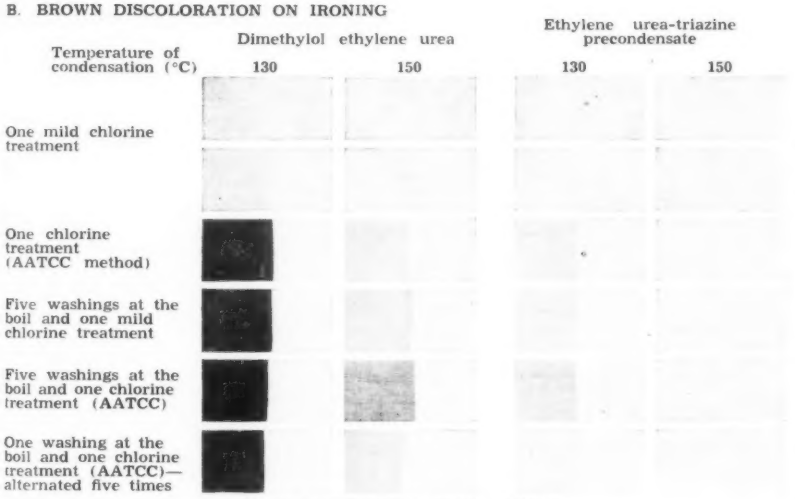

B. BROWN DISCOLORATION ON IRONING
Dimethylol ethylene urea
Ethylene urea-triazine precondensate
Temperature of condensation (°C)
130
150
130
150
One mild chlorine treatment
One chlorine treatment (AATCC method)
Five washings at the boil and one mild chlorine treatment
Five washings at the boil and one chlorine treatment (AATCC)
One washing at the boil and one chlorine treatment (AATCC)—alternated five times
Ironing temperature: 220°C (428°F)

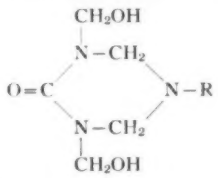
Figure 14

chlorine treatments affect these properties, we have subjected the reactant-resin finishes to six different procedures corresponding to conditions of actual use, as follows, and have subsequently tested them in the manner previously outlined:

1) one mild treatment with chlorine (one gram of active chlorine per liter, at 20°C, or 68°F, and pH 9.5);
2) one chlorine treatment according to the AATCC method (2.5 g active chlorine per liter, at 27°C, or 81°F, and pH 11;
3) five washings at the boil and one mild chlorine treatment;
4) five washings at the boil and one chlorine treatment according to the AATCC method;
5) 20 washings at the boil and one chlorine treatment according to the AATCC method;
6) one washing at the boil and one chlorine treatment according to the AATCC method, each repeated alternately five times.

An analysis of the brown discoloration on ironing (Figure 14) and the chlorine damage (Figure 15) indicates that the type of chlorine wash had relatively little influence but that a decisive factor was whether or not any washings at the boil preceded treatment with chlorine. On the other hand, it was relatively less essential whether the number of washings at the boil prior to treatment with chlorine was only five or twenty. It is further of interest that almost identical results were obtained with either five washings at the boil followed by a single final treatment with chlorine (procedure No. 4 above) or with five washings at the boil alternated each time with a chlorine treatment (procedure No. 6 above). The intermittent chlorine treatments thus have no practical effect, provided no hot drying or ironing is carried out in between.

In the USA, where particular attention has been paid to the problem of chlorine damage after alkaline washing, triazone resins, in addition to the above-mentioned nitrogen-free resins, have also been developed. According to Nuessle (*1*), the most important one is the 1,3-dimethylol-5-alkyl-2-perhydrotriazone compound.



This is also a compound the nitrogen atoms of which are fully blocked. Investigations have shown that the buffering capacity of the triazone resins exceeds that of the dimethylol ethylene urea resins. In fact, it assumes somewhat of an intermediate position compared with the buffering capacity of dimethylol ethylene urea and dimethylol melamine. Evidently the triazone resins have not yet been widely introduced into actual use and they appear to have some disadvantages. Thus, Nuessle reports (*1*) of their great tendency to have a fishy odor, of their relatively lesser fastness to washings at the boil compared with that of ethylene urea resins, and of the tendency of fabrics treated with triazone resins to yellow during ironing, whereby this latter phenomenon is considered a process not so much of scorching as of discoloration.

The ethylene urea-triazine precondensate that has already been described is a reactant resin of a type that yields a degree of chlorine fastness otherwise unknown for nitrogen-containing resins when suitably condensed in the presence of the proper catalysts. The finisher may find it of interest to learn to what extent this type of resin is able to do justice to the other requirements of a wash-and-wear finish. We have therefore compared this new synthetic-resin product with the other types of resin in a series of experiments—especially however, with dimethylol ethylene urea—with respect to the variation of crease angle and loss in tensile strength (Schopper) produced by temperature of condensation (Fig-

C. CHLORINE DAMAGE

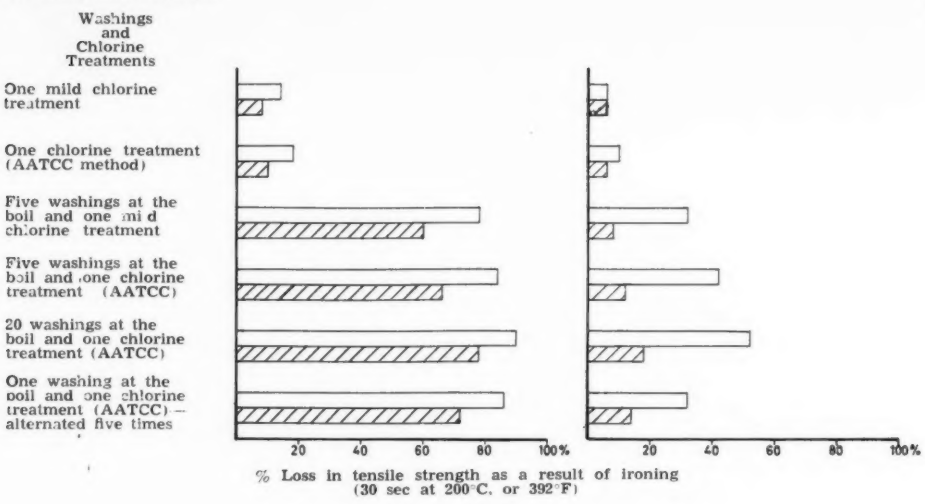

Washings and Chlorine Treatments
One mild chlorine treatment
One chlorine treatment (AATCC method)
Five washings at the boil and one mild chlorine treatment
Five washings at the boil and one chlorine treatment (AATCC)
20 washings at the boil and one chlorine treatment (AATCC)
One washing at the boil and one chlorine treatment (AATCC) – alternated five times
20 40 60 80 100%
20 40 60 80 100%
% Loss in tensile strength as a result of ironing (30 sec at 200°C. or 392°F)

Figure 15

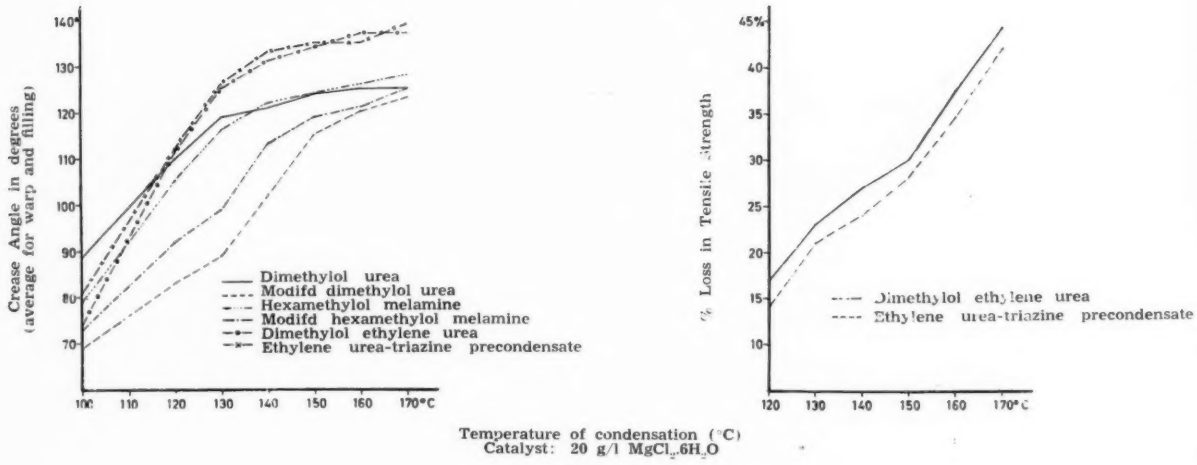


Figure 16

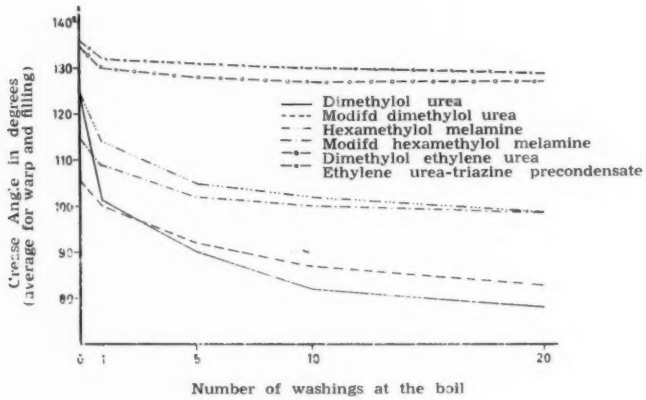


Figure 17

ure 16), permanency of crease angle (Figure 17), and no-iron effect (Figure 18). The fabric used in these tests, the concentration of synthetic resin, the amount and type of catalyst added, as well as the conditions of finishing were comparable with those employed in the tests for the determination of chlorine fastness.

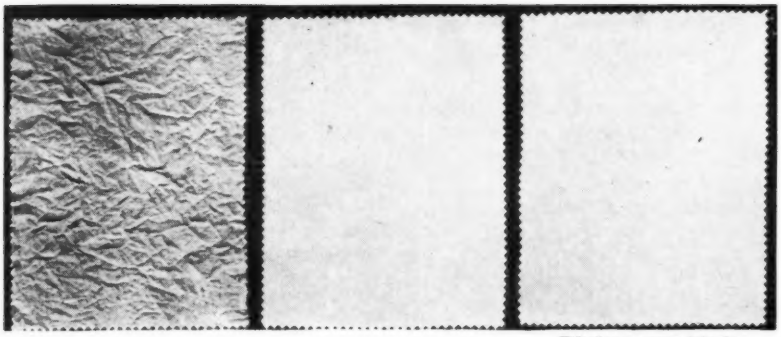
As may be gathered from Figures 16-18, there is a striking correspondence in the behavior of the ethylene

Five washings at the boil

Blank without resin | Dimethylol ethylene urea | Ethylene urea-triazine precondensate

Figure 18a

Ten washings at the boil



Blank without resin | Dimethylol ethylene urea | Ethylene urea-triazine precondensate

Figure 18b

urea-triazine precondensate and the dimethylol ethylene urea with respect to crease angle and fastness to washings at the boil as well as to the no-iron effect. Both products in the presence of magnesium chloride yielded very good crease angles, which were unobtainable on cotton by means of the other tested resin types. It may be seen that a condensation temperature of 140°C (284°F) sufficed to achieve almost optimal values. As may be deduced from Figure 17, the permanency of these crease effects, when alkaline washings at the boil were carried out, was maintained in the case of both of the above reactant resins. The latter also exhibited the same permanency in the case of slightly alkaline washings at the boil when the wash water contained perborate or percarbonate. This is important inasmuch as most ready-mixed household detergents contain such oxidizing agents. In the case of melamine-resin finishes, and even more so in the case of carbamide-resin finishes, the crease angle is very much reduced by washing at the boil. In addition, as Ruemens (*8*) also remarks, the crease effects of carbamide resins are reduced even more by neutral than by alkaline washings at the boil. The no-iron effect obtained is illustrated by photographic reproductions of the test pieces after five and after ten washings at the boil (Figure 18). Only test pieces of fabric treated with the two reactant resins were thereby compared with a piece of untreated fabric. Figure 16 shows the relation between percent loss in tensile strength and curing temperature. In addition to the known fact that a rise in temperature of condensation is accompanied by an increased loss in tensile strength, the curves indicate further that the decrease in tensile strength was noticeably less when ethylene urea-triazine precondensate rather than dimethylol ethylene urea was used. These observations, which were made in laboratory tests, were confirmed by practical experience.

Generally, it may be said that the ethylene urea-triazine compounds have a greater tendency to crosslink than do the pure ethylene urea compounds. Research carried out up to the present time was concerned with the performance of these compounds in cotton finishing. The reason for this is that finishes of white cotton shirts are much more likely to suffer from chlorination and concomitant damage than are finishes for staple-rayon fabrics, since the latter are more often colored and are therefore as a rule not subjected to such severe washing. However, as the thought of wash-and-wear finishes for fabrics of staple rayon as well is gaining interest, the performance of the mixed ethylene urea-triazine condensate on these should also be mentioned briefly. In addition to fastness to chlorine, the finishers desire above all wet crease resistance (no-iron characteristics), dry crease resistance, a reduction in swelling value (faster drying), and resistance to shrinking. All these finishes should at the same time possess a high degree of fastness to wash-in, without a noticeable loss in resistance to abrasion. The resin finish that meets all these demands 100% has yet to be found. Pretreatment with alkali may improve the conditions for obtaining good crease resistance in the wet state but the loss in abrasion resistance, as well as the more difficult and less economical finishing process have as yet prevented the pretreatment of fabrics of staple rayon with alkali from gaining the acceptance it deserves. In this connection, it will be worthwhile to continue observing the progress of resin finishing, with special consideration of the conditions affecting rayon staple fiber.

In view of the greater percentage of amorphous substance as well as the relatively lesser density of packing and lesser average degree of polymerization of staple fiber in comparison with cotton, however, the use of dimethylol ethylene urea resins on fabrics of staple fiber does not permit one to achieve the fastness to washing at the boil that was obtained on cotton. The filling of the large interstices within the fiber and the blocking of the amorphous substances are rather of greater importance here, so that it will not be possible, in the case of rayon staple fiber, to forego completely the use of self-linking resins. From this point of view, the ethylene-triazine reactant resin, with its relatively stronger tendency to crosslink, is more suitable for finishing staple rayon fiber than is the pure dimethylol ethylene urea resin. Both types excel by virtue of exceedingly negligible residual shrinkage and great fastness to washing, but the handle obtained with the mixed condensate is more suitable for rayon staple fibers (ie, the resin has a more filling effect). The previously mentioned fastness to light and the possibility of employing zinc catalysts make this product very interesting

for use with rayon staple.

A combination of a deeply penetrating, low-molecular-weight resin that crosslinks with the fiber and of an ordinary, self-linking resin appears to us a suitable product for imparting wet crease resistance to staple rayon. To this may be added precondensed types of resin of higher molecular weight, which have a filling effect, in order to improve the no-iron characteristics and to modify the hand. The reactant resins are particularly suitable for achieving good shrink values for cotton as well as for staple rayon. If still another finishing agent is added, the use of one that becomes washfast through fixation by the synthetic resin is recommended, since flabbiness produced by the washing out of the filling agent would be very detrimental to the no-iron appearance of the staple-rayon fabric. In this connection we also refer the reader to the work done by Wannow (7).

SUMMARY

A survey has been made of the performance of thermosetting resin finishes subjected to treatments with chlorine, and in this connection test results are reported as a means of directing special attention to the increase in chlorine-absorption capacity and chlorine damage exhibited by ethylene urea-resin finishes after washing at the boil. The extent of this chlorine damage is not proportional to the degree of chlorine retention that may be determined analytically. It is established by means of experimental investigations and interpretations of structure that a reduction in chlorine damage during hot ironing may be traced to the basicity of the nitrogen-containing compounds used. At the same time, it must be noted from the start that the amount of retained chlorine that may be analytically determined also remains small. The objective of the developmental work was reached by means of building in potentially basic groups into the new ethylene urea-triazine resin. Under normal conditions these groups do not increase chlorine retention, but, under the conditions of hydrolysis on ironing, they do become fully effective.

The following factors have been considered with reference to their effect on fastness to chlorine:

1) Type of synthetic resin
2) Type of catalyst
3) Intensity of condensation, or cure
4) Type of chlorine treatment and number of precedent washings at the boil.

The most significant practical result of these investigations turned out to be a reduction in the condensation temperatures hitherto recommended and described for obtaining chlorine-fast finishes, from 160-180°C (320-356°F) to 140-150°C (284-302°F) for a curing period of approximately four minutes. Although the time of drying may be reduced to two to three min- of this product with respect to water repellency in combination with the proper finishing agents should also be mentioned. Metal salts, such as zinc chloride and magnesium chloride, have proved to be suitable catalysts.

Finally, the two reactant resins dealt with above are partially compared with carbamide and melamine resins with respect to crease angles, the fastness to washing at the boil of the latter, reduction in tensile utes for very high temperatures of condensation, the use of the latter is in itself a great source of danger and presents difficulty in the plant. The newly developed ethylene urea-triazine resin makes it possible to obtain excellent chlorine-fast finishes at considerably lowered temperatures of condensation and, consequently, with a high degree of plant safety. A number of further advantages are described. The favorable performance strength, and wash-and-wear properties, and the results of these tests are given.

The authors thank Mr M Menke for making the graphs shown in this article.

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BOOK REVIEW

Principles of Cotton Printing

Published by "Publication Committee for Prof Kale's Book on Cotton Printing," 25/A Mahadev, Nagar Ahmedabad -14, Bombay, India
Distributed by: W S Heinman, 400 East 72nd St, New York 21, NY
$10.00; pp XIII + 451

The contents of this volume are divided into four sections: the mechanics of printing (103 pages), the preparation for printing (24 pages), the styles of printing (287 pages), the aftertreatment and finishing of prints (17 pages).

The coverage of printing equipment, methods of printing, printing styles, and formulas is quite complete. There is an extensive presentation of formulas for each style of printing and for various combinations of styles. Approximately 100 of these formulas are illustrated by swatches of fabric printed with the formulas. A similar number of diagrams and pictures are presented in the text.

This volume should prove a convenient reference source to those interested in cotton printing. Many of the printing methods and formula are, however, obsolete in this country. ———RJP

Organic Synthesis: An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals (Volume 39)

Max Tishler, Editor-in-chief
John Wiley and Sons, New York, N Y (1959)
vii & 114 pp; 15.5 x 23.5 cm; $4.00

Volume 39 of "Organic Synthesis" contains the method of preparation for 30 organic compounds. Directions have been submitted by various contributors and each preparation has been carefully checked by competent chemists. The informaton given for each compound includes in addition to the actual procedure, the common name, "Chemical Abstracts" index name, equations, notes on the procedure, and additional methods of preparation. The cumulative index lists all material contained in Volumes 30-39 inclusive. Of added interest is a brief section dealing with the "Submission of Preparations" for publication in "Organic Synthesis."

This series is too well known to justify an elaborate description. It is sufficient to say that the same high standards are maintained as in previous volumes.———RMP

Proceedings of the

American Association of Textile Chemists and Colorists

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January 11, 1960 No. 1

COUNCIL HIGHLIGHTS

217th Meeting • Sheraton-Atlantic Hotel, New York, NY • November 20, 1959

COUNCIL voted approval of two $500 scholarships to be awarded to the two Sections having the greatest increase in membership during the forthcoming year. For this purpose, the Sections would be divided into two groups—those with 300 members or less and those with 300 or more. These scholarsips would be limited to undergraduate students majoring in a course in textile chemistry and/or dyeing at a recognized college in the U S or Canada. The proposal, made by the Committee on Individual Membership, is now subject to review and approval by the Appropriations Committee.

* * *

Proposals made by Messrs Appel and Paine, following their meetings with officials of the Society of Dyers and Colourists in connection with *Colour Index* matters, were approved by Council.

President Helmus summarized the Appel-Paine report, citing several benefits which, he stated, would accrue to AATCC under a revised arrangement stemming from the joint recommendations of representatives of both societies.

Mr Helmus read a letter from SDC's General Secretary, John W Nicholls, stating that the proposed arrangement had been approved by SDC's Council on November 4. Mr Helmus stated that it was the general opinion of the AATCC Executive Committee that a final document embodying the joint recommendations should be prepared by the Association's general counsel and submitted to the Society.

* * *

The following appointments, approved by the Executive Committee on Research, were approved by Council:

W G Klein, Fabric Research Laboratories, to replace G Switlyk, chairman of the Statistical Advisory Committee (RAS-67)

J Turer, L Sonneborn Sons, Inc, to replace F H Steiger, chairman of the Committee on Static Electricity on Textiles (RA-32)

A C Nuessle, Rohm and Haas Co, to replace R F Aurich, chairman of the Committee on Damage Caused by Retained Chlorine (RA-35)

E Artim, J C Penney Co, to replace J F Warner, chairman of the Committee on Dimensional Changes in Textile Fabrics (RA-42)

V L Chase, Interchemical Corp, to replace J E Norton, chairman of Committee on Colorfastness to Light (RA-50)

V D Lyon, E I duPont de Nemours & Co, to replace R B Smith, chairman of the Committee on Colorfastness to Washing (RA-60)

C Horowitz, Yardney Chemix Corp, to Committee on Antibacterial Agents (RA-31)

F B Shippee, Gagliardi Research Corp, to Committee on Antibacterial Agents (RA-31)

H J Leavitt, General Electric Co, to Committee on Water Resistance of Fabrics (RA-63)

G E Mona, Sayles Finishing Plants, to Committee on Water Resistance of Fabrics (RA-63)

D P Feyler, American Viscose Corp, to Committee on Colorfastness to Light (RA-50)

F A Prisley, Brookneal Mills, to Committee on Colorfastness to Perspiration (RA-52)

R S Hunter, Hunter Associates Labs, to Committee on Color (RA-36)

A A Dunham, U S Testing Co, to Committee on Wash and Wear (RA-61)

F Hausner, Spring City Knitting Co, to Committees on Bleaching (RA-34) and Dimensional Changes in Textile Fabrics (RA-42)

R Zerbey, Snow White Bleachery, to Committees on Bleaching (RA-34) and Dimensional Changes in Textile Fabrics (RA-42)

L B Arnold Jr, Vikon Chemical Co, to Committee on Antibacterial Agents (RA-31)

Reporting for ECR, Charles W Dorn reported:

The Committee on Bleaching had presented a new test method on the determination of alkali in bleach baths containing hydrogen peroxide. ECR had approved the test for submittal by letter ballot to TCR.

The Committee on End Usage Performance Tests had requested its name be changed to End-Use Performance of Textiles. ECR had approved the request.

The Committee on Dimensional Changes in Textile Fabrics had proposed a new test method on woven or knitted fabrics for submittal by letter ballot to TCR. ECR had approved.

ECR approved that the Committee on Definitions be changed to a reference Committee.

Mr Dorn reported that the blue lightfastness standards were in short supply. F J Rizzo would supervise production of a new lot. ECR recommended that the inventory be replenished with a ten-year supply, and that $10,000 be appropriated as a capital expense.

Mr Dorn stated that, in a recent conference with Mansfield Lonie of the Department of Commerce, he was assured that the tentative test on flammability sponsored by the NFPA would not be acceptable inasmuch as the Standing Committee on Commercial Standards was made up largely of textile people who understood the problems.

* * *

Elliott Morrill, chairman of the Committee on Membership and Local Sections, reported that the AATCC membership count as of November 1, 1959 was 7,018.

* * *

Leonard Smith, 1959 Convention Chairman, reported that total attendance at Washington was 1870, of which 1630 were members. Receipts were expected to exceed disbursements by approximately $9,500.

* * *

Council approved several transactions recommended by the Appropriations Committee, as well as a request for a $10,000 capital expense for a new supply of blue lightfastness standards.

Southeastern Section———

SYMPOSIUM ON NONWOVEN FABRICS

I. AREAS FOR NONWOVEN FABRICS ADVANCEMENT*

PAUL A HOMIER
Callon Division
Callaway Mills Co
LaGrange, Ga

INTRODUCTION

AFTER several years in the nonwoven field, I am still impressed by the great challenge it offers today. The past ten years have seen rapid progress in raw materials, methods of manufacturing, and finished fabrics. It has grown from experimental units to a substantial industry.

Despite the rapid advancement in this field, only a small percentage of the potential volume has been achieved. After listening to the following letter, received from a potential customer, you will understand what I mean.

* * *

"Dear Mr Homier:

"I have evaluated the cotton fabric you submitted and believe it shows great promise; however, there are a few changes listed below in order of their importance:

1) The price must be reduced at least 10¢. (*The list price was 20¢*)
2) The thickness is not bad, but should be increased from 15 to 20 mils.
3) It has to be much stronger.
4) The hand is too harsh, it should be much softer and more flexible.
5) It must be whiter.
6) If volume sales are to be made, it must contain a large percentage of nylon for advertising purposes.
7) Weight is not too important. You can go twice as heavy, if necessary, maybe even higher.

"Now, you have the problem, it is up to you and your staff! Can we expect a sample next week? We must move fast, or we'll miss the season. This should be big volume business, and you should plan to keep a large stock on hand for us."

* * *

A letter of this sort is received with varying degrees of emotion, depending on your sense of humor, the time of day, and what kind of day you have had. Consideration should be given to the fact that he gave someone credit for being a genius. He did say he expected that sample next week—didn't he?

Seriously however, while there is room for improvement and we cannot do the impossible, let's take a look at what can be done.

DISCUSSION

BINDERS———The chemical industry has spent considerable time and money in developing binders for the nonwoven fabric industry. The binders have improved in the past few years in such areas as heat aging, solvent resistance, gas fading, colorfastness, whiteness and lack of odor. Insufficient improvement has been made in binder strength and softness for many applications. The binders not only must be stronger, but have to be able to utilize their strength by improved adhesion to the fiber, either physically or chemically. There is a possibility of a chemical finish that would chemically react with both fiber and binder. This union would result in a stronger bond which would resist deterioration under all conditions.

If a stronger soft binder could be used at a lower concentration, a soft, drapeable, fabric-like hand would result. This would allow nonwovens to enter such fields as outerwear, draperies, curtains, slip covers, and increase their use in the fields where they are presently being sold.

The cost of such binder, unless a lower percentage can be used, must not exceed $1 per pound. The present volume uses require a lower cost; however, the better fabric fields will warrant one dollar/pound.

I sincerely feel that stronger binders with better fiber-adhesive qualities offer one of the largest "breakthrough" areas for progress of the nonwovens.

FIBERS———The industry has many synthetic fibers, eg, nylon, Dacron, Acrilan, etc, which exhibit several of the properties required by nonwoven fabrics. They are strong, have good colorfastness, and are not affected by solvents, gas fading, ultraviolet light, etc. The cost of these synthetics is too high for most of the present nonwoven fabric uses. In addition, the full strength of the fiber is not realized, due to the type of fiber surface and lack of adhesion by the binder. A more irregular surface for a physical bond or one with reactive groups for the binder to react with chemically would result in a nonwoven with superior physical properties. A cheaper fiber is needed with good tensile and shear strength to impart better tensile and tear strength to present nonwovens. A fiber which would have good binder adhesion, but not allow the binder to penetrate, would retain its fiber integrity and produce a good, tough fabric with same or improved properties.

Polyethylene and polypropylene fibers display some of the fiber requirements for industrial use, such as low density, good tensile and shear strength. Suppliers of these fibers indicate the price will drop to a reasonable range for nonwovens when large-scale production is achieved. On the other hand, they have poor heat resistance, bad shrinkage properties, and are difficult to pigment dye.

FINISHING———The third possible area for advancement of nonwoven fabric is finishing, which is far more of a virgin field than those previously discussed. The present finish-

*Presented during a symposium on nonwoven fabrics held in conjunction with a meeting of the Southeastern Section on September 12, 1959 at Ida Cason Callaway Gardens, Pine Mountain, Ga.

ing by manufacturers of nonwovens usually consists of padding on color, treating to eliminate odor, or washing to soften a fabric. Attempts have been made to jig dye, nap, preshrink, and compressive shrink; however, these trials merely consisted of taking a nonwoven fabric and treating it exactly in the same manner as a woven cloth. This procedure usually resulted in failure and was the end of the experiment.

The finishing of nonwovens, to be successful, is going to require concentrated effort by the textile finishing industry; which will have to develop special machines and treatments. The equipment, skill and know-how of the established finisher is required if nonwovens are to realize the true advantages that can be achieved similar to those obtained by woven cloth. A piece of woven cloth in its greige state is hardly saleable as a consumer item. Yet this, in many instances, is what the nonwoven industry is attempting to do.

Let's consider napping of a nonwoven fabric. I know of at least fiive separate attempts made in the past decade to nap nonwoven fabrics, and I am sure that at least three times that many attempts have been made, which are unknown to me. Some of the reasons for napping are to improve:

Softness
Drape
Appearance
Gluing Surface
Moisture pick-up

The test goes like this: A short roll is sent to a finisher for napping. The finisher usually has an old napper, in poor condition, that is not in use any more, but at least it won't slow down his production. The nonwoven is put on the machine, and the sweeper is taken off his regular job to run the sample. Two settings are usually used, one too open, the other too close. The results are that one piece is untouched, and the other is torn apart. End of test.

Napped nonwovens could be a big market, but no one has attempted to modify the wire or method of handling this different cloth. It must be remembered, the nonwoven has a plastic bonding agent, and will require different processing than a woven cloth made only of fiber. I firmly believe that a good experienced technician, proper equipment, and modification of same could solve this problem.

I guess the basic problem in nonwovens today is making a fabric soft enough. It is no problem to make the fabric strong, but this results in too stiff a fabric. The quickest solution to this problem appears to be finishing. It could be done by any of the untold number of methods used by finishers or a combination of these methods. Some possibilities are washing, loop drying, relaxed drying, compressive shrinking, stretching, shrinking, calendering, jig drying, waterproofing, etc. Any combination of these could also be directed to improve appearance of a particular fabric and make it more desirable for consumer use.

CONCLUSION

There is talk of nonwoven outerwear as common goal; however, progress should be taken in steps. One should strive for smaller improvements that would increase sales in the present fields of vinyl backing, filters, interlining and interfacing, etc, and bring business quickly to those who make improvements possible.

In closing, I ask the chemical industry to continue its good work and diligently pursue special formulas for nonwoven use. The fiber industry has excellent fibers for woven cloth, but special thought should be given to use of fiber in conjunction with binder for nonwovens. The finishing industry should closely examine the nonwoven field and see if it isn't missing an opportunity which, if pursued, would be beneficial to all concerned.

II. PROPERTIES OF ACRILAN NONWOVEN FABRICS AS A FUNCTION OF FIBER LENGTH, DENIER, AND BINDER CONTENT*

D C NICELY
The Chemstrand Corp
Decatur, Ala

PROPERTIES of bonded nonwoven fabrics are dependent upon a number of variables. The most important variables are the fiber by type, length and denier, and the bonding system which holds the fiber together in a nonwoven sheet.

A research project was undertaken in the laboratory to study the properties of nonwoven fabrics made with Chemstrand's Acrilan acrylic fiber and a selected binder. A variety of fiber deniers and cut lengths could be made available readily.

The fiber was processed through a Rando-Webber to form a randomly oriented web structure weighing 2.25 ounces per square yard. The web was collected on kraft paper and taken to the laboratory. Strips of web and the supporting paper were cut about nine inches wide. A piece of moistened nonwoven sheet (Interlon) was placed on the fiber web, and the assembly was inverted. A second cover sheet was placed on the web to form a sandwich with the web in the center. The sandwich was saturated with the binder solution and was then passed through a set of squeeze rolls to leave a specified binder add-on. The cover sheets were removed from the wet web, and the web was placed in a drying oven for ten minutes at 250°F. The fabric was then cured at 280°F for four minutes.

The binder selected was Rhoplex B-15, which is well known and commonly used. Single saturation was employed. The binder add-on was held at 25% ± 3% resulting in a binder-fiber ratio of 25% - 75%. The finished fabrics weighed 3.0 ounces per square yard.

Samples were maintained in standard conditions in the textile testing laboratory for a minimum of twenty four hours prior to testing. Tensile, tear and elongation were determined with an Instron tester. A standard Mullen burst tester was used to obtain bursting strength.

*Presented during a symposium on nonwoven fabrics held in conjunction with a meeting of the Southeastern Section on September 12, 1959 at Ida Cason Callaway Gardens, Pine Mountain, Ga.

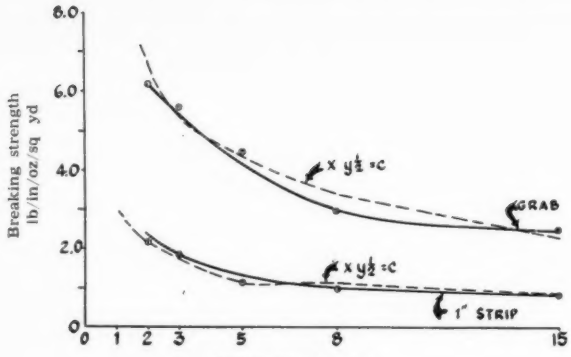


Figure 1
Tensile strength vs denier

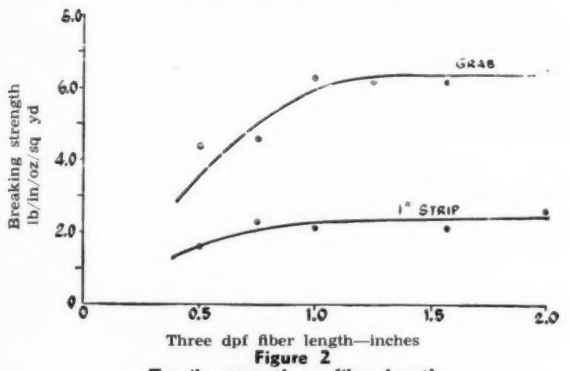


Figure 2
Tensile strength vs fiber length

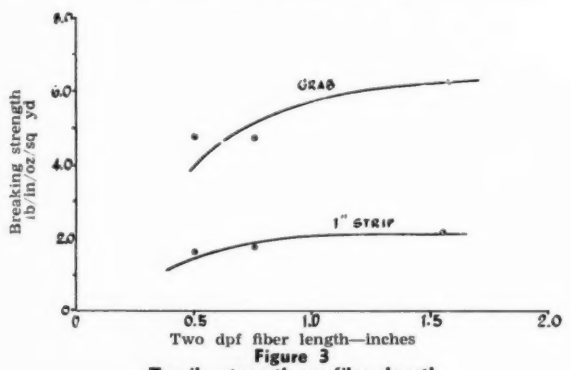


Figure 3
Tensile strength vs fiber length

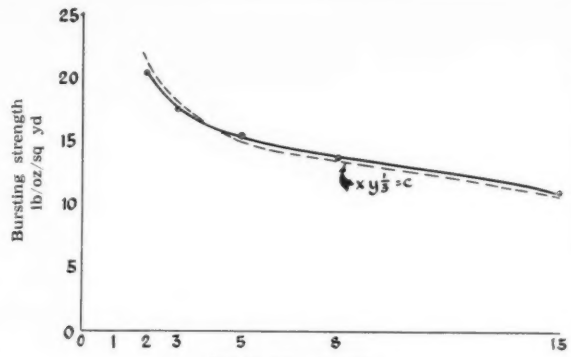


Figure 4
Mullen burst vs denier

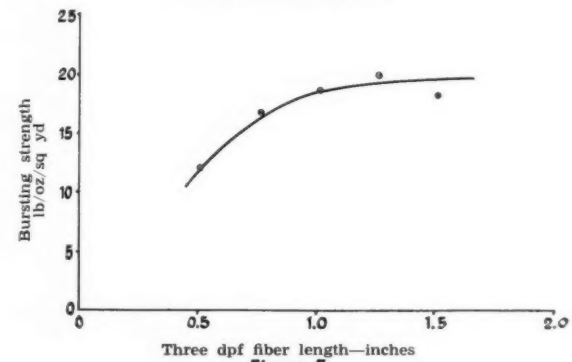


Figure 5
Mullen burst vs fiber length

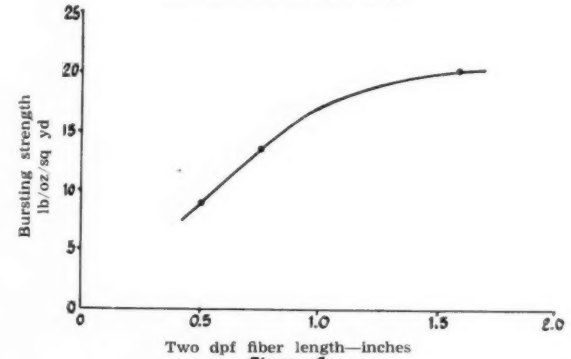


Figure 6
Mullen burst vs fiber length

In Figure 1 is illustrated the effect of fiber denier on tensile strength by both the grab method and the one-inch-strip method. It will be noted that the strength is highest with the lowest denier fiber, and the strength decreases rapidly as the denier is increased. The tensile strength as measured by the strip method is about 30 to 40% of the values shown for the grab method of measurement.

It is interesting to note that these plots approach curves having the formula

$$xy^{1/2} = c$$

in which
x = strength,
y = denier, and
c = constant.

Fiber denier is proportional to the cross-sectional area of a fiber, and fiber diameter is proportional to the square root of denier. The number of fibers per unit weight is inversely proportional to denier, and the circumference or area available for bonding is proportional to the square root of denier.

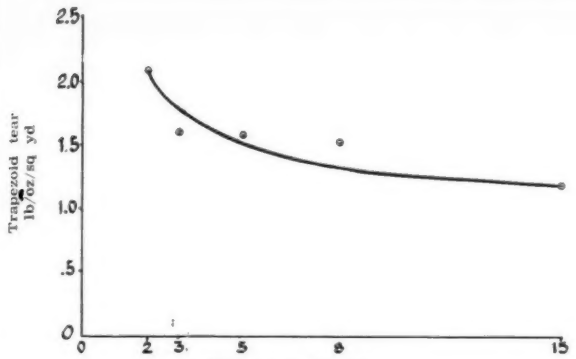
The curve of the plot of strength can thus be seen to be a function of the number of fibers per unit weight (or area).

With three-dpf Acrilan of different staple lengths, the tensile strength of the fabric increases as the fiber length is increased from one-half to one inch as noted in Figure 2. Fabric strength does not increase appreciably with fiber length greater than 1". Strength measured by the strip method is about 40% of the strength by the grab method. Similar characteristics are noted for two-dpf Acrilan, as can be seen in Figure 3.

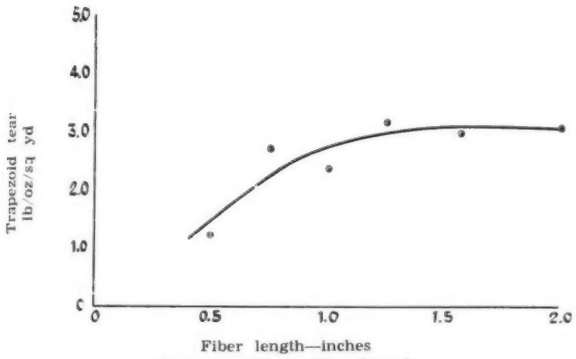
The bursting strength of a bonded fabric as shown in Figure 4 decreases as the denier increases (constant fiber length) with the curve approximating that of

$$xy^{1/3} = c$$

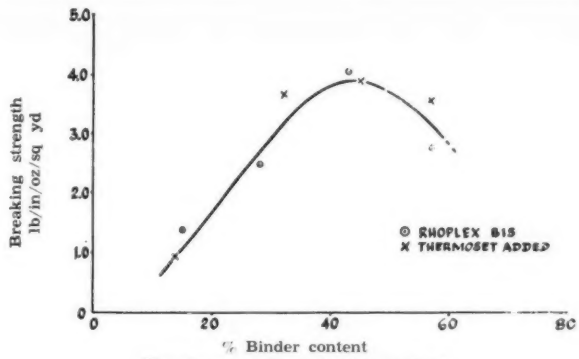
in which
x = bursting strength,
y = denier, and
c = constant.



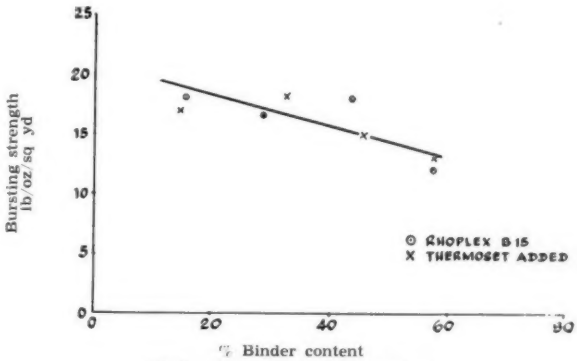
Tear strength vs denier
Figure 7



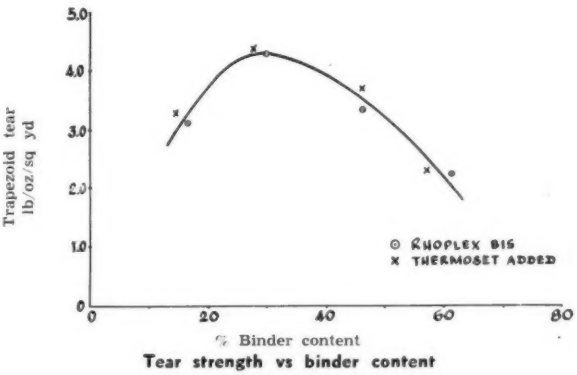
Tear strength vs fiber length
Figure 8



Tensile strength vs binder content
Figure 9



Mullen burst vs binder content
Figure 10



Tear strength vs binder content
Figure 11

On the other hand, when denier is held constant, as with two- and three-dpf Acrilan, the bursting strength increases progressively as the staple length is increased up to about 1.5 and does not appear to change with increased fiber length over 1.5 inches. (See Figures 5 and 6). This might be explained to some extent by the method of testing since the opening in the Mullen burst test fixture is only 1.2 inches diameter, and there could be a possibility that fibers in excess of this length might bridge the test fixture opening. This then would be a measure of fiber strength rather than the strength of the bonded structure.

Trapezoid tear strength decreases as the denier of the fiber decreases, whereas the strength increases rapidly until a maximum is reached at about 1.25″ fiber length. Lengths in excess of 1.25″ do not improve the trapezoid tear strength, as seen in Figures 7 and 8.

As an extension of the project, a study was made to determine the effect of binder content on the physical properties. Using a constant weight web, binder was padded on in varying percentages. Each web was weighed carefully before and after bonding so that the binder add-on could be calculated for each sample within reasonable limits. Again, a 2.25-ounce, three-dpf, 1-9/16″ Acrilan fiber web was used. Rhoplex B-15 with and without a thermoset resin addition was padded on the base web. Usual drying and curing provisions were observed.

Strip tensile, as shown in Figure 9, appears to be linear up to about 40% binder content both with and without the thermoset cure.

Mullen burst values seem to follow a linear pattern up to approximately 40% binder and then drop to some extent. The difference in strengths when using the binder with or without the thermoset cure does not seem to be significant. (See Figure 10).

For trapezoid tear values, the non-modified binder gave slightly higher values than the binder with a thermoset cure. Figure 11 illustrates the trend of trapezoid tear values with binder content with optimum values obtained at about 30% binder.

III. STYLING & DECORATING ACETATE NONWOVENS

E L CLEMENTS, H W COATES and C E LAYMAN

Celanese Fibers Co
A division of Celanese Corp of America
Charlotte, NC

INTRODUCTION

THIS discussion will be limited to an investigation of processes and techniques which are adaptable mainly to acetate fibers. It will be attempted to show how the basic properties of this fiber may be utilized to create desirable aesthetic effects in nonwovens.

Five topics will be presented, namely:

1) Solvent dyeing of acetate nonwovens.
2) Acetate silk screening and machine printing.
3) Plasticizers—dye—acetate fiber combinations.
4) Acetate molded fiber forms.
5) Technique for securing three-dimensional effects.

In discussing each topic, an attempt will be made to demonstrate the versatility of acetate fiber in addition to showing how fiber properties, such as thermoplasticity and ease of dyeing, may be used to achieve new styling effects. Acetate fiber has established itself in the woven field as a styling fiber in such fabrics as taffetas, antique satins, crepes and ninons. Ease of styling of these fabrics has been largely due to the following basic fiber properties:

a) Ease of processing.
b) Silk-like appearance of fiber.
c) Ability to be used with other fibers for cross-dye effect.
d) Bright or dull luster.
e) Ease of dyeing and dye receptivity.
f) Moderate water absorption and moisture regain.
g) Desirable properties of hand.

SOLVENT DYEING

The solvent-dyed nonwoven samples were made from non-oriented fiber webs containing either 100% acetate staple or a blend of acetate and viscose-rayon staples. The base fabrics were resin impregnated with an acrylic-type resin, dried and cured. Less attention was given to the formation of the webs from the point of view of creating good hand, drapeability and strength than was given to the solvent-dyeing technique.

Dyed samples were prepared as follows:

Seven-inch-wide strips of fabrics were cut to accommodate a three-roll laboratory padder. These strips were then fed through the solvent-dye solution, which was held a 77°F (25°C), followed by padding at 40 yards per minute at moderate pressure. Disperse, acid and premetallized dyes, which are compatible in one dyebath, were dispersed in warm alcohol, 140° F (60°C), after which water was added to make at total of 100 parts. The dye mix was padded on the fabric at 40 ypm at moderate pressure. The fabrics were then dried in hot air at a temperature of approximately 250°F (121°C).

The following are typical dyebath formulations for 100%-acetate fabric.

Mint Green
2.0 parts Eastman Fast Yellow 8GLF
0.25 parts Eastman Fast Blue B-GLF
75.0 parts ethyl alcohol
22.75 parts water
Dyebath temperature—77°F (25°C)

Navy
3.0 parts Lenra Blue RLS
75.0 parts ethyl alcohol
22.0 parts water
Dyebath temperature—77°F (25°C)

Brown
1.6 parts CI Acid Brown 19
0.8 parts CI Acid Brown 45
75.0 parts ethyl alcohol
22.6 parts water
Dyebath temperature—77°F (25°C)

Many other dye formulations are possible depending on the shade and color desired.

Optimum lightfastness can be obtained with this procedure by dyeing with selected dyestuffs. Recommended dyestuff groups for dark shades are acid, premetalized and disperse, while for light-to-medium shades, disperse dyes are preferred.

Hand washing [one gram/liter soap flakes at 104°F (40°C) for 10 minutes] is considered a satisfactory wash-test evaluation for solvent-dyed acetate nonwovens. Where unconditional washfastness is desired, the solvent-dyed fabrics should be afterwashed in order to remove traces of surface dye.

Acetate and rayon blends may be union, reserve or cross dyed to give various styling effects. The following formulations were developed to demonstrate the styling potential possible with nonwoven acetate/rayon blends. This can be demonstrated by these procedures: a) pad-steam process (acetate/viscose—both dyed), b) pad-dry-wash (acetate dyed only—viscose white), and c) pad-dry-salt rinse (203°F-95°C)—rinse-dry.

The following represent typical formulations for reserve and cross-dyeing effects:

For acetate shade—lime, and rayon shade —medium blue
2.0 parts Artisil Direct Yellow 6GL
0.25 parts CI Direct Blue 100
75.0 parts ethyl alcohol
22.75 parts water

For acetate—medium blue, and viscose — white
2.0 parts Interchem Acetate Bull Blue NSP
75.0 parts ethyl alcohol
23 parts water

For acetate—black, and viscose—white (stained slightly)
2.0 parts Cibalan Black BGL

For acetate—dark brown
1.6 parts Irgalan Brown 3BL
0.8 parts CI Acid Brown 45
For viscose—yellow
1.0 part Superlitefast Yellow EFC (250%)

Note: A water rinse is necessary following dyeing in order to remove stain from the viscose.

SCREEN AND MACHINE PRINTING OF ACETATE NONWOVENS

Standard screen- and machine-printing methods may be used on acetate nonwoven fabrics.

The following outlines the procedure for preparation of a laboratory printing paste which is to be applied with a standard geometrically designed screen:

a) Two grams of methylcellulose is dispersed in 25 cc of water at 203°F (95°C).
b) Desired dyestuff (disperse, acid or premetalized type) is dispersed in 75 cc of hot (140°F-60°C) ethyl alcohol and added to the paste with constant stirring.
c) Paste is then cooled to room temperature.

Typical shade choices are as follows:

*Presented during a symposium on nonwoven fabrics held in conjunction with a meeting of the Southeastern Section on September 12, 1959 at Ida Cason Callaway Gardens, Pine Mountain, Ga.

a) Dark red — 2% CI Acid Red 57
b) Orange — 2% CI Disperse Red 35
c) Blue — 1% CI Acid Blue 102
d) Navy — 3% Lenra Blue RLS (disperse)
e) Dark green — 2% Xylene Milling Yellow P (acid)
1% Eastman Fast Blue B-GLF (disperse)

For improved washfastness in either printing or pad dyeing, 5% of Phenyl Cellosolve ($C_6H_5OC_2H_4OH$) may be added to the dye formulation.

PLASTICIZER - DYE - ACETATE FIBER CONSTRUCTIONS

Plasticizers have been used for some time as a bonding medium for acetate fibers. Bonding is achieved by virtue of the fact that the plasticizer lowers the effective fusion point of the fiber and, under the influence of heat, one fiber bonds or fuses to the other.

Plasticizers may be applied by spraying techniques subsequent to web formation or by preplasticizing the acetate staple prior to web formation. In either case the application of heat to the plasticized web affects fusion bonding. The sprayed-type web is characterized by the lack of evenness in bonding through depth while the preplasticized web does provide even depth bonding. Colored waddings (battings) were produced in the laboratory by the incorporation of dyestuffs with plasticizer, which serves as a bonding agent and dye dispersant.

The formulation of dyestuff/plasticizer combination was carried out as follows:

Disperse Dyestuff
2.0 parts Interchem Acetate Brill Blue NSP
2.0 parts triethyl phosphate
96.0 parts dimethoxy ethyl phthalate
The dyestuff was first dissolved in the triethyl phosphate, followed by addition of the dimethoxy ethyl phthalate.

Acid Dyestuff
2.0 parts Irgalan Navy Blue 2GL
or
CI Acid Red 57
or
Xylene Milling Yellow P
33.0 parts dimethoxy ethyl phthalate at 180°F (82°C)
65 parts dimethoxy ethyl phthalate at room temperature
The dyestuff was dispersed in the hot plasticizer followed by addition to the cold plasticizer: The total mix was then filtered to remove impurities.

The depth-bonded dyed samples were produced as follows:

a) The plasticizer-dye composition, 10% on the weight of the fiber, was applied to the staple in a blending/opening hopper during the opening process.

b) The treated fibers were then processed through a web former followed by curing at 350°F (177°C) for three minutes.

While only a limited number of dyes have been used, the results indicate that various dyes may be added to acetate plasticizers, such as glyceryl diacetate, trichlorethyl phosphate, glyceryl triacetate.

The surface-sprayed samples were produced as follows:

a) 100% acetate fibers were processed into a nonwoven web weighing approximately 6.0 oz/sq yd.

b) 10% of the plasticized dye combination was applied to the web (5% applied to each side of the web).

c) The sprayed web was then heat bonded for two to three minutes through a hot-air oven set at approximately 350°F.

It will be understood that percentage add-on of the plasticizer and web weight will determine the time/temperature relationship to be used.

ACETATE FIBER MOLDED FORMS

Acetate fiber lends itself readily to molding operations due to its inherent thermoplastic nature. The ability to mold to any shape is enhanced by the use of selected plasticizers. The actual amount of pressure required during molding will vary widely depending whether a flexible or rigid article is required.

Plasticizer-treated acetate fibers are placed in the desired shaped mold either in batting or fluff form. The packing density of the fibers in the mold will control to a large extent the relative hardness of the molded object. It is estimated that a packing density of two to five grams per cubic centimeter is practical. Heat bonding time will be dictated by the shape, thickness, and volume of the mold. For example, certain samples may be molded in approximately three minutes at 350°F (177°C).

Another type of shape molding is readily achieved by placing metal or clay mock-up of the shape desired on top of a web of plasticized acetate fibers and subjecting the whole assembly to hot-air heat at 350°F for approximately three to four minutes. Potential applications for plain or colored molded forms might be found in the packaging and display field. Shock resistance and compression-recovery characteristics may be engineered into contour-molded forms as protection devices for delicate mechanical and electronic instruments. The possible use of such products in the apparel and household trades can be only a matter of conjecture at this time.

TECHNIQUE FOR SECURING THREE-DIMENSIONAL EFFECTS

The successful lamination of a woven, knitted or nonwoven acetate fabric to a nonwoven batting in either wadding or bonded form is determined by the time/temperature/pressure relationship and the addition of a suitable plasticizing agent.

Experience has shown that there are many plasticizers which will give satisfactory bonding of the two materials. Among these are glyceryl diacetate, glyceryl triacetate, dimethoxyethyl phthalate, with glyceryl diacetate giving the best bond for washing and drycleaning.

The samples were prepared as follows:

A 3.5-ounce per square yard needle-punched acetate batting was passed under a spray mist of glyceryl diacetate. Approximately 0.4 ounces of the glyceryl diacetate was applied to each square yard of the batting. The treated batting was then air dried about three minutes until it became tacky. In actual production, this air-drying process may be accelerated by the use of a hot-air blast just prior to embossing. The overlay fabric (woven or nonwoven) was then brought in contact with the treated batting and the two passed through an embossing roll at a speed of approximately 12 yards per minute and four tons pressure while being maintained at a temperature of 350°F (177°C). The embossed fabric was then given a final cure for five minutes in a hot-air oven set at 315°F (157°C).

Most any pattern can be applied to the laminated fabric by changing the design of the embossing roll.

The acetate nonwoven backing gives the structure a three-dimensional effect by accentuating the pattern design in the non-embossed areas of the laminate. The final curing operation following embossing allows bonding in the nonpressure areas, which gives the structure greater stability.

SUMMARY

While the process and techniques discussed are general recommendations based on laboratory pilot-plant equipment, translation of these techniques to production facilities is believed to be possible. These studies

relative to acetate fiber indicate that the chemists and colorists of the textile industry have a wealth of existing knowledge which can be applied to nonwoven products when such products are adequately engineered for processing by known arts.

Such properties as fiber- and binder-processing uniformity, fabric strength, and binder dyeability are all prerequisites for good dyeing and finishing. Recognition must be given to the efforts of binder manufacturers during the last several years, which have developed bonding agents with improved lightfastness properties and dyeability.

Acetate fiber may be processed by any of the conventional nonwoven techniques used in the industry. The purpose of this presentation, however, has been to present some of the processes by which acetate nonwovens may be given styling and decorative effects by the use of solvent-dye or plasticizer-dye combinations. These processes in no way preclude the use of other bonding/dyeing techniques now used in the textile industry.

ACKNOWLEDGMENT

The preparation of this paper would not have been possible without the counsel, advice and assistance of the following members of the Charlotte Development Laboratories, Celanese Corporation of America: G C Ward, J S Warner, D T Dunlap, and Wm Loftin.

Report of the Committee on Evaluation of Enzyme Agents

THE Committee on Evaluation of Enzyme Agents met at the AATCC Convention at Washington, DC, on October 8, 1959. Those present were:

F J DiCarlo, *chairman*
W H Bartholomew
Herman Brown
Joseph Creeley
J A Komninos
W C Lindsly
P J Wood

The adoption of a reference method for assaying enzymes was agreed upon. P J Wood will make laboratory trials of a modified existing enzyme assay method. His work will then be studied by the other three enzyme producers in the Committee. A meeting will be held on January 18 in New York with the object to adopt a reference enzyme assay method.

ACTIVITIES OF THE LOCAL SECTIONS

Piedmont

PROGRAM for the Piedmont Section's Winter Meeting, to be held Jan 22-23 at the Poinsett Hotel, Greenville, SC, has been announced.

Registration will be held from 2 to 6 pm on Friday and from 9 am to 6 pm on Saturday in the hotel's lobby.

The General Research Committee will meet in the Ballroom at 10 am Saturday to hear W F Robertson, vice president in charge of production, Riegel Textile Corp, offer a general discussion of research in textiles.

At noon, the Officers Luncheon will be held in the Statesman Room.

The afternoon technical session will begin at 1:30 in the Ballroom, at which time Norman S Cassell, Interchemical Corp, will speak on "New Horizons in Pigment Printing". Victor S Salvin, Celanese Corp of America, will discuss "Accelerant Dyeing of Hydrophobic Fibers", the subject of the Piedmont Section's second-prize-winning 1959 Intersectional Contest paper.

A Social Hour in the Club Room, beginning at 6, will precede the Annual Banquet, slated for 7:30 in the Ballroom. Banquet speaker will be R C Edwards, president of Clemson College.

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Western New England

FORTY members and guests attended the December 4th meeting of the Western New England Section held at Cavey's Restaurant, Manchester, Conn.

Speaker of the evening was Roger C Steinhauser, Applications Research Group, Victor Chemical Works, who spoke on "New Developments in the Flameproofing of Textiles".

Correction

ON page 33 of the November 30, 1959 issue, it is incorrectly stated that James E Miller had been elected secretary of the Mid-West Section, and that Arthur J Andrews had been elected treasurer.

Mr Andrews was elected secretary, and Mr Miller, treasurer.

Delaware Valley

DELAWARE VALLEY SECTION will next meet at Kugler's Restaurant, Broad and Chestnut Sts, Philadelphia, Pa, on January 22.

Speaker of the evening will be Walter W Burbank, vice president, Permachem Corp, West Palm Beach, Fla, who will discuss "Total Environmental Control".

Total Environmental Control is a dramatic new term in the world of health. The talk will trace the history of disease and disease control from early history through the discoveries of Lister and Pasteur, which lead to our present-day battle against contamination through the use of spot sterilization and the use of temporary action germicides.

The new concept of Total Environmental Control was developed in research and the treatment of hospitals here and abroad. Using examples from hospital tests, Mr Burbank will show how the mass of textile areas, including sheets, blankets, uniforms, clothing, etc, can be converted from sources of contamination to sources of effective decontamination.

The significant contribution that can be made by the textile industry in the Total Environmental Control program will be outlined. The use and application of long-lasting germicides in clothing, bedding, decorative and other types of fabrics will be presented together with future probabilities.

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Hudson-Mohawk

FIFTY-FIVE members and guests attended the November 20, 1959 dinner and technical meeting of the Hudson-Mohawk Section at Jack's Restaurant, Albany, NY.

Henry E Millson, assistant technical director of the Dyes Department, American Cyanamid Co, Bound Brook, NJ, presented a talk, supplemented with movies, on "Fundamentals of Dyeing and Microscopical Studies with Time-Lapse Motion Pictures." A question-and-answer period on Dr Millson's talk was conducted by Vice Chairman Achilles Mafilios.

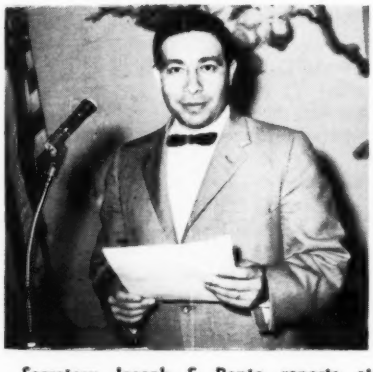
The Section's next meeting will be held this Friday, January 15, at the Chelsea House, Tribes Hill, NY, at which time Raymond Thornton, technical service manager, Arnold, Hoffman & Co, Inc will speak on "Procions and the Procinyl Range of Fiber-Reactive Disperse Dyes for Cotton and Nylon."

ANNUAL MEETING • NORTHERN NEW ENGLAND SECTION • DECEMBER 4, 1959

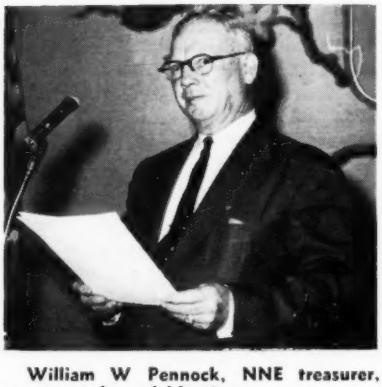
(See page 39 of December 28, 1959 issue)

NORTHERN NEW ENGLAND SECTION OFFICERS FOR 1960—Seated, l to r: William W Pennock, treasurer; Edward J McNamara Jr, vice chairman; Robert D Robinson, chairman; Joseph S Panto, secretary. Standing, l to r: Bennett S Gesmer, Daniel Frishman, and Herbert L Orstein, Sectional Committeemen; John J O'Neil and Gerald F Quigley, National Councilors. Absent when photo was taken were Robert J Peirent, National Councilor, and Donald H Thomas, Sectional Committeeman

Norman R S Hollies, research supervisor, Harris Research Laboratories, delivering talk before Northern New England Section on Dec 4. Dr Hollies presented a summation of the efforts of a number of groups working for the armed forces in an attempt to achieve wool-like properties in blended fabrics.



Secretary Joseph S Panto reports at Annual Meeting of Northern New England Section, held Dec 4.



William W Pennock, NNE treasurer, reports at Annual Meeting

NNE Chairman Robert D Robinson (left) greets Norman R S Hollies, guest speaker at Dec 4 meeting

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTEES
Jan 21-22 (Hotel Sheraton-Atlantic, New York, NY); Jan 21—Council Committees and Research Committees; Jan 22 (AM)—ECR, TCR; Jan 22 (PM)—Council
May 12-13 (Hotel Sheraton-Atlantic, New York, NY); May 12—Council Committees and Research Committees; May 13 (AM)—ECR, TCR; May 13 (PM)—Council

NATIONAL CONVENTIONS
Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); Sept 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

DELAWARE VALLEY SECTION
Jan 22 (Kugler's Restaurant, Philadelphia, Pa)

HUDSON-MOHAWK SECTION
Jan 15, Mar 27 (Chelsea House, Tribes Hill, NY); May 20 (Ladies Night); June 24 (Annual Outing)

METROPOLITAN SECTION
Jan 15, Feb 19 (Hotel New Yorker, New York, NY); Mar 18, Apr 22 (Kohler's Swiss Chalet, Rochelle Park, NJ); May 20 (Ladies Night—Swiss Chalet); June, 1960 (Outing)

MID-WEST SECTION
Feb 6 (Bismarck Hotel, Chicago, Ill; June 18 (Outing, Cerami's Island View Resort on Browns Lake, Burlington, Wis)

NORTHERN NEW ENGLAND SECTION
Jan 15 (Joint symposium with ASME Textile Engineering Div, Woodlawn Golf Club, Newton, Mass)

PACIFIC SOUTHWEST SECTION
Feb 5, Mar 18, May 13 (meetings); July 16 (picnic); Sept 24-25 (outing); Nov 18 (meeting); Dec 10 (dance)

PIEDMONT SECTION
Jan 22-23 (Poinsett Hotel, Greenville, SC); Apr 2-3 (Hotel Robert E Lee, Winston-salem, NC); June 3-4 (Outing—Ocean Forest Hotel, Myrtle Beach, SC); Sept 23-24 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION
Jan 29 (Johnson's Hummocks); Mar 25 (Providence Engineering Soc); Apr 29 (Student Night); June 24 (Outing—Metacomet Country Club); Sept 23 (Management Night); Oct 28 (Providence Engineering Society); Dec 2 (Annual Meeting—Johnson's Hummocks)

SOUTH CENTRAL SECTION
Feb 7 (Hotel Patten, Chattanooga, Tenn); May 13-14 (Outing—Riverside Hotel, Gatlinburg, Tenn); Sept 10, Dec 9 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION
Feb 13, Apr 16 (Ida Cason Callaway Gardens, Pine Mountain, Ga); June 10-12 (Outing—Radium Springs Lodge, Radium Springs, Ga); Sept 10, Dec 3 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION
Jan 15, Mar 14 (Rapp's Restaurant, Shelton, Conn); Apr 8 (Hartford, Conn, area); May 6 (Ladies Night, Rapp's Paradise Inn, Ansonia, Conn); June 10 (Outing, Wallingford Country Club—tentative); Sept 23 (Blake's Restaurant, Springfield, Mass); Oct 21 (Annual Meeting, Rapp's Restaurant, Shelton, Conn); Dec 2 (Rapp's Restaurant, Shelton, Conn)

Membership Applications

November 26—December 9, 1959

NEW ENGLAND REGION

Western New England Section

Senior

Raymond J Murray—Asst dyer & chemist, Falls Co, Norwich, Conn. Sponsors: F H Casey, E M Taft Jr.

Rhode Island Section

Transfer to Senior

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William F Turner—Chemist, res & dev, Cranston Print Works Co, Cranston, RI. Sponsors: R H Phillips, E W Lawrence.

CENTRAL ATLANTIC REGION

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Charles G Germanetti—Plant mgr, secty, treas, Vivitone Inc, Paterson, NJ. Sponsors: S Maiolo, M G Bruckman.

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Charles H Rosenberg—Plant mgr, Passaic Color & Chem Co, Passaic, NJ. Sponsors: I Kuchnisky, B Hodes.

Associate

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Pravinkant H Sanghani—Textile chemist, American Cyanamid Co, Bound Brook, NJ.

Transfer to Senior

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Senior

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Junior

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John D Miskie—Research chemist, Joseph Bancroft & Sons Co, Wilmington, Del. Sponsors: H R Hushebeck, R S Babiarz.

Donald K Saylor—Chemist, Joseph Bancroft & Sons Co, Wilmington, Del. Sponsors: H R Hushebeck, R S Babiarz.

Richara C Smith Jr—Chemist, Tech service, Joseph Bancroft & Sons Co, Wilmington, Del. Sponsors: H R Hushebeck, R S Babiarz.

Associate

Robert R Kern—Tech div, liaison chemist, Quaker Chemical Products Corp, Conshohocken, Pa.

Transfer to Senior

Bob A Worley—Chemist, Joseph Bancroft & Sons Co, Wilmington, Del. Sponsors: H R Hushebeck, R S Babiarz.

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Helen F Riddell—Liaison & scientific advisor, U S Army, Pentagon, Washington, DC. Sponsors: F H Forziati, M K Wharton.

Eleanor D White—Textile technologist, Harris Research Labs, Washington, DC. Sponsors: A E Davis, L E Fourt.

Associate

Ruth K Stoller—Lab tech, Harris Research Labs, Washington, DC. Sponsors: A E Davis, J Menkart.

Piedmont Section

Senior

Mary E Clayton—Lab tech, Metro-Atlantic Inc, Greenville, SC. Sponsors: W E Iannone, J C King.

Lee H Kitson—Boss printer, Carlisle Finishing, Carlisle, SC. Sponsors: J O Blinkhorn, R L Hunter.

Junior

Charles A Funderburke—Finishing dept foreman, Rock Hill Printing & Finishing Co, Rock Hill, SC. Sponsors: W E Edwards, J C King.

Transfer to Senior

Rodney L Coleman Jr—Asst supt, Rev Div, Cone Mills Corp, Greensboro, NC. Sponsors: J W Holland Jr, G F Walz.

Philip D Cunningham—Tech rep, Glyco Chemicals, Div Chas Huisking Co, Williamsport, Pa. Sponsors: R E Rettew, A J Owens.

Lindsay P Dixon—Textile chemist & colorist, Tech Serv Dept, American Enka Corp, Enka, NC. Sponsors: H L Reed, G G Flatow.

C Eugene Hunter—Sales engr, design work, McSpadden, Scantland & Hunter, Charlotte, NC. Sponsors: B B Scantland, L Kennette.

South Central Section

Senior

Clarence V Jayne Jr—Research chemist, American Bemberg Div, Beaunit Mills Inc, Elizabethton, Tenn. Sponsors: H L Rowden, W O Neeb.

Russell M H Kullman—Chemist, Southern Utilization Res & Dev Div, USDA. New Orleans, La. Sponsors: J D Reid, R M Reinhardt.

Milton W Smith—Dyer, Miller Smith Hosiery Mill, Chattanooga, Tenn. Sponsors: L R Greenwood, E Jurczak.

Southeastern Section

Transfer to Senior

Gordon K Empting—Supt wet processing, The Bernhard Altmann Texas Corp, San Antonio, Texas. Sponsors: G R Thompson, G M Kidder.

WESTERN REGION

Mid-West Section

Senior

Elroy S Alvarez—Color chemist, Ben Rose Textiles, Chicago, Ill. Sponsors: W D Paine, J L Eich.

Carl L Sudbrink—Dyer, Phoenix Dye Works, Cleveland, O. Sponsors: J H Jones, R B Henthorn.

Junior

Michael B Gunn— Lab technician, Hilton Davis Chem Co, Cincinnati, O. Sponsors: R D Wiggins, R A Majors.

Associate

James F Polk—Colorist, Art Textile Corp, Highland, Ill.

STUDENT CHAPTER

Bradford Durfee College of Technology

Raymond R Bachand Jr—Student, Bradford Durfee College of Technology, Fall River, Mass. Sponsor: C E Medde.

UNCLASSIFIED

Senior

Earl E Berkley—Dir of ACCO Fiber & Spinning Lab, Anderson, Clayton & Co, Houston, Texas. Sponsors: G R Thompson, G M Kidder.

Kim Moon Sang—Dean, prof of tex dept, Engineering College of Seoul National University, Seoul, Korea. Sponsors: G P Paine, H W Stiegler.

December 10—December 23, 1959

NEW ENGLAND REGION

Northern New England Section

Senior

George R Feeley—Lab asst chemist, E J Feeley Co, Boston, Mass.

Sponsors: H J Carlin, W A Stickney Jr.

John M Feeley Jr—Asst chemist, E J Feeley Co, Boston, Mass. Sponsors: H J Carlin, W A Stickney Jr.

Junior

Edward E Richard—Asst plant chemist, Defiance Bleachery, Barrowsville, Mass. Sponsors: C P Mangion, E Smith.

Western New England Section

Transfer to Senior

Daniel F Crean—Textile chemist, American Cyanamid Co, Stamford, Conn. Sponsors: J J Black, A O Mogensen.

Rhode Island Section

Senior

Donald A Campbell—Chemist, C H Masland & Sons, Wakefield, RI. Sponsors: F H Casey, E Field.

Transfer to Junior

John M Peret—Chemist, Warwick Chem Co, Div Sun Chem, Wood River Junction, RI. Sponsors: G M Kidder, G J Mandikos.

CENTRAL ATLANTIC REGION

Metropolitan Section

Senior

Max Birnbaum—Tech dir, Atlantic Chem Corp, Nutley, NJ. Sponsors: A Lubin, J A Komninos.

Sam N Bruno—Salesman, Atlantic Chem Co, Passaic, NJ. Sponsors: A Lubin, J A Komninos.

Israel L Sonenshein—Vice pres, Atlantic Chem Corp, Passaic, NJ. Sponsors: A Lubin, J A Komninos.

Leonard A Weiner—Chief chemist, Atlantic Chem Corp, Nutley, NJ. Sponsors: A Lubin, J A Komninos.

Junior

James L Gleim—Dye sales trainee, American Cyanamid Co, Bound Brook, NJ. Sponsors: E I Stearns, N E Johnson.

Associate

J Warren Blaker—Asst prof, Fairleigh Dickinson Univ, Teaneck, NJ.

John D Saunier—Products mgr, Borne Chemical Co Inc, Elizabeth, NJ.

Transfer to Senior

Roland L Collet—Purchasing agent, Fair Lawn Finishing Co, Fair Lawn, NJ. Sponsors: H Moore, G M Kidder.

Nicholas J Giglio—Asst finisher & head examiner, Fair Lawn Finishing Co, Fair Lawn, NJ. Sponsors: H Moore, G M Kidder.

Howard C Royce—Exec vice pres, Royce Chem Co, Carlton Hill, NJ. Sponsors: R L Jones, P J Wood.

Theodore Vogel—Dyes application res, American Cyanamid Co, Fibers Div, New York, NY. Sponsors: D Shieldkret, R J G Schofield.

Delaware Valley Section

Senior

Frank K Patterson—Chemist, Joseph Bancroft & Sons, Wilmington, Del. Sponsors: R S Babiarz, J Christie.

Associate

Leonard W Adams—Senior market analyst, Koppers Co Inc, Pittsburgh, Pa.

Transfer to Senior

Richard E Seaman—Research supv, E I duPont de Nemours & Co, Inc, Wilmington, Del. Sponsors: A G Scroggie, F Schulze.

SOUTHERN REGION

Washington Section

Junior

Mervin O Parker Jr—Res asst, chemist, Harris Research Labs Inc, Washington, DC. Sponsors: J F Krasny, A E Davis.

Piedmont Section

Frank M Gibson—Chemist, Greater Greenville Sewer District, Greenville, SC. Sponsors: R E Rettew, J C King.

William B Lavender—Tech sales rep, Atlantic Chem Corp, Passaic, NJ. Sponsors: A Lubin, J A Komninos.

Junior

John F Senn—Lab Tech, Dow Chemical Co, James River Div, Williamsburg, Va. Sponsors: J Moore, A R Wirth.

Associate

R Wayne Blessing — Salesman, Procter & Gamble Distributing Co, Cincinnati, O.

Alonzo A Burris Jr—Gen mgr, Burris Products Co Inc, Charleston, SC.

Transfer to Senior

Claus W Busch Jr—Tech sales rep, American Cyanamid Co, Charlotte, NC. Sponsors: J M Smith, J M Rhodes.

Southeastern Section

Senior

John C Payne—Plant supt, Cotswold Fibres Inc, Columbus, Ga. Sponsors: R K Federal, J H Holmes.

James D Boggus—Chemist, res & dev, Marble Products Co of Georgia, Whitestone, Ga.

WESTERN REGION

Mid-West Section

Senior

Zilvester Bergman — Application technologist, Dow Chemical Co, Midland, Mich. Sponsors: N W Abernethy, T A Sparta.

Buddy G Pettigrew—Product engr, Dow Corning Corp, Midland, Mich. Sponsors: E M Eddington, R A Ford.

Pacific Southwest Section

Senior

Everett E Smythe—Dyer, Dyemasters, Inc, Inglewood, Calif. Sponsors: P F Noonan, R C Demuth.

Associate

Winona N Brooks—Asst prof, Home Economics, Los Angeles State College of Applied Arts & Sciences, Los Angeles, Calif.

STUDENT CHAPTERS

Alabama Polytechnic Institute

Charles D Smith—Student, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox.

Conway C Watson—Student, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox.

North Carolina State College

Philip N Jacobs—Student, North Carolina State College, Raleigh, NC. Sponsor: E S Mullis.

Philadelphia Textile Institute

Stasia M Mallast—Student, Philadelphia Textile Institute, Philadelphia, Pa. Sponsor: W H Hughes.

UNCLASSIFIED

Maza Xavier Pister—Chem engr, chemist & dyer, Mercerizados y Acabados Modernos, SA, Calz de Tlalpam, Mexico, DF, Mexico. Sponsors: C H McCandless, T H Hart.

Gottfried J Duerig—Head of group for testing & application for chem specialties, Ciba Co Inc, Basel, Switzerland. Sponsors: P J Luck, E A Wolfe.

YOUR attention is called to an error which appeared on page 48 of the November 2 issue in the article entitled "Valko, Chapin and Williams Honored at Awards Luncheon".

At the beginning of the second column it is stated erroneously that the paper which won the 1959 American Dyestuff Reporter Award was Charles R Williams' "Mechanisms Influencing the Wash and Wear Characteristics of Cellulosic Fibers".

The Award-winning paper was Mr Williams' "Quantitative Measurement of Fabric Appearance—Practical Evaluation of Wash and Wear Characteristics", which appeared in the February 23, 1959 issue of ADR.

* * *

In the November 30 issue, on page 32, under "AATCC Deceased", the name of David W Crookall of Kenilworth, NJ appears erroneously.

Elected to Membership

December 16, 1959

No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
*indicates transfer from another class of membership

NEW ENGLAND REGION

Northern New England Section

Harry A Freedman *
Joseph P Geraghty *

Western New England Section

John T Wiser
Thomas H Bolcer
Hartley W Eastwood *
Charles A Smith *

Rhode Island Section

Charles A Lamendola (A)
David A Morris *

CENTRAL ATLANTIC REGION

Metropolitan Section

Edward G Bobilin
Gerald R Ferrante
Paul Harencak
James W Monks Jr
Rubin Rabinowitz
Oscar K Schwarz
David M Hegeman (A)
Ernest Nittelholzer
David S Bernzweig *
George S Dominguez *
Saunders W Gropper *
Joseph R Nosal *
Howard M Sprock *
William Tannenbaum *
Philip D Turits *
Michael F Costello *

Hudson-Mohawk Section

Irwin J Smith III (J)
Stanley J Sieckowski *

Niagara Frontier Section

Walter H Kral
John C Morris
Thomas S Quealy *

Delaware Valley Section

Edward G Hughes
Morton Santymire
Joseph T Seawell
Robert E Vellner (J)
Felix A Buskey (A)
Richard H Brehm II *
Maurice I Seifer *
Bob A Worley *
Edmund A Zavaglia *

SOUTHERN REGION

Washington Section

Geraldine H Pickering *
Manuel A Thomas *
Franklin C Hoak *

Piedmont Section

Cleveland C Judd Jr
William H Holden Jr
John W Marshall
Marvin Schram
Paul B Price
Patrick R O'Connell
Richard W Chalk Jr (J)
William E Mathews (A)
Clyde B Anderson *
John B Baughn Jr *
Harry L Beam *
William A Brandon *
John E Howard *
Albert McLuckie *
Clifton B Rhodes *
Floyd H Simpson *
William O Stone Jr *
Calvin Taylor *
Kenneth C Williamson
Cornelius B Young *

South Central Section

Jesse L Roberts Jr
Frank F Harris Jr
Robert L Bridgman *
William B Elmer *
Frank A Hirsh
John E Lancaster *

Southeastern Section

Daniel F Crean *
Norman R Brookins *
Billy M Phillips *
C Scott Akers (A)

WESTERN REGION

Mid-West Section

Jean M Eggert
Thomas A Sparta
Billy G Simpson
Harold R Keesling
Blaine O Pray
Kjell J Rosenlind *
Ernest Larrat Jr *
Monica C Meagher *

Pacific Northwest Section

Hubert N Shea (A)

Pacific Southwest Section

John F Eurich
Elizabeth F Thomas

STUDENT CHAPTERS

Alabama Polytechnic Institute

Richard A Beaird (S)
Thomas D Bivin Jr (S)
Larry E Clark (S)
Decie J Finney (S)
Benny J Lee (S)
Alton F Painter (S)

Georgia Institute of Technology

Virgil DeWayne McHone (S)

North Carolina State College

Volker D Arendt (S)
Randall L Brown (S)
Candell W Clark (S)
Joe D Gardner (S)
Ted E Hager (S)
Jean A Hamilton (S)
Charles E Huffstetler (S)
Roland Acra (S)
Steve C James (S)
Yalcin Kermen (S)
Harold R Mann (S)
Ronald R Medders (S)
Ruiz V Von Sales (S)
Delton R Thompson (S)
Donald R Tickle (S)
Doris K Gruenstein (S)

Philadelphia Textile Institute

Norman W Beetham Jr (S)
Carmine R Buglione (S)
Zory R Glaser (S)
Edward W Gleadall (S)
Martin P Kaplan (S)
Robert J Maddalena (S)
William M Maynard (S)
William J Mountain (S)
Jay R Panziere (S)
Bernadette V Petrauskas (S)
Albert Rhodes (S)
Arthur Rhodes Jr (S)
George K Seelig (S)
Barry M Shay (S)

Rhode Island School of Design

Doris M Broadbent (S)
James C Cannon (S)
Bruce R Richmond (S)
Francis A Tessier (S)

UNCLASSIFIED

Arnold G Bolliger *
John Boulton
Damien Bournival (J)
Edwin M Cobe
James E Davis
Farouk M Dossa *
Gerard Gagne (J)
Jacinto Maceda Nantaring Jr
Narhari H Shah *
Thakor P Patel *
Norman T Rassie *
Teodora T Sylianco *
Lewis J Turner Jr *

News of the Trade

Texize Acquires IPI

Texize Chemicals, Inc has acquired the capital stock of Industrial Products, Inc. Both companies manufacture and distribute textile sizing and finishing products and have factories in Greenville, SC.

The Industrial Products plant will continue in operation, Texize president W J Greer said, and there will be no change in personnel or sales policies of Industial Products under the new ownership.

The acquisition of this company enables Texize Chemicals to further expand its development and research program and offer even better service to mills and finishing plants, Mr Greer said.

John B League is president and secretary of Industrial Products and Charles J Peterson is vice president and treasurer. Industrial Products was organized to manufacture and distribute warp sizing and finishing materials in 1933 and was the first company of its kind in Greenville.

The purchase climaxes a steady growth of the Texize operation since its formation in 1945. Organized to serve the textile industry with sizing and other chemical compounds, Texize in a period of 14 years spread its distribution throughout the United States and Canada with all manufacturing being done in Greenville.

W N Kline Jr is vice president and sales manager of the Textile Division of Texize.

Texize Textile Division sales showed a 20 percent increase for 1958, and the 1959 sales picture is expected to reveal another substantial growth year for the division, Mr Greer said.

•

New Allied Facility

Announcement of a new Allied Chemical production facility at Orange, Texas for the manufacture of polyethylene glycols was made last month.

Allied Chemical reportedly is ready to offer from its stocks at Orange, Texas, or from stock points throughout the country, PEG 200, 300, 400, 600, 1000 and 1450 in tankcar and drum quantities; and in combination shipments with other glycols and/or ethanolamines.

Polyethylene glycol is reacted with fatty acids to form esters. These in turn are used as emulsifying, dispersing, plasticizing and lubricating agents.

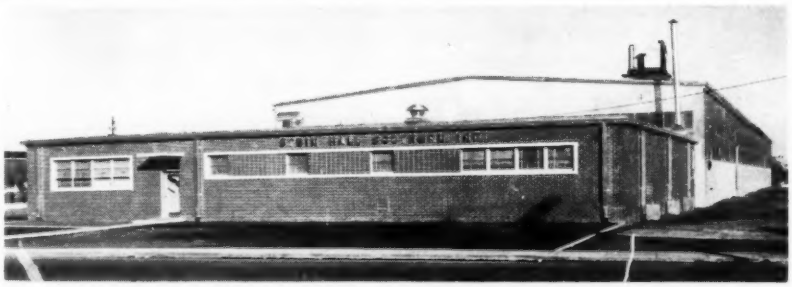
IMPORTANT NOTICE

IT will be noted that, with this issue, a new method of page identification has been initiated.

Pages are numbered consecutively throughout the issue, as has been the case since February 23, 1959. However, in addition to this, non-advertising pages contain a second number in parentheses, which will aid the many readers who have asked us to return to our former numbering system (by volume) for editorial pages.

In certain instances, the number in parentheses is preceded the letter "P". This will serve to identify pages devoted to the Proceedings of the American Association of Textile Chemists and Colorists.

Your attention is also called to a change in style in the folio. The publication name and date of issue have been brought together in a manner which, it is felt, will be more attractive and of greater utility to the reader.



Stein Hall Southern Inc, Charleston, SC

New Stein Hall Subsidiary in South

Stein Hall & Co, Inc, New York, dedicated a new subsidiary, Stein Hall Southern Inc, in Charleston, SC on November 20.

General Mark W Clark, World War II military leader and president of The Citadel, headed the committee of state and city officials which welcomed the company to its new $800,000 plant and warehouse. The building was erected under the direction of South Carolina State Ports Authority as a part of the area's resurgence as a leading port city of the South.

The dedication ceremonies were attended by South Carolina civic and government leaders and included key men from textile, paper manufacturing and food processing industries for whom Stein Hall Southern is designed to be a prime supplier of commodities through its manufacturing and world-wide importing operations.

The new Charleston plant has as its manager Harry Vogel, formerly assistant plant manager of another Stein Hall subsidiary, the Stein-Davies Company, Long Island City.

The plant will process guar, a gum extracted from the seed of the guar plant which grows in India and Pakistan. The processed product, Stein Hall's *Jaguar*®, is used in a number of important industries including textiles.

Vogel

Stein Hall Southern will also produce starch products for warp sizing in the textile industry as well as for the paper industry.

In addition, Stein Hall Southern will use Charleston's port facilities to import a broad range of products including burlap, latex, tapioca and sago flours, natural gums, tea, potato starches and dextrines.

Stein Hall Southern is Stein Hall's fifth subsidiary and seventh manufacturing plant. Other recently established operations included a new plant in Charlotte, NC and a subsidiary, Stein Hall S A (Pty) Ltd, Johannesburg, South Africa.

• NAMES IN THE NEWS •

Stokes

Charles F Stokes has been appointed New England manager for Carbic-Hoechst Corp's Dyestuff Division.

Mr Stokes was associated with Inter chemical Corporation before joining Carbic in 1945. He has been active in AATCC, having served as secretary of the Rhode Island Section for many years.

Mr Stokes will make his headquarters in the new office and laboratory building of Hoechst Chemical Corp located at 129 Quidnick Street, West Warwick, RI.

•

Frank Gonet, the U S Tariff Commission's expert on coal-tar intermediates and dyes, assumed the duties and responsibility of chief of the Chemical Division on December 1, and *Thomas J Scott*, the Commission's expert on petroleum, assumed additional duties as assistant chief. The Chemical Division prepares the Commission's annual report on *Imports of Coal-Tar Products* and the preliminary and annual reports on *Synthetic Organic Chemicals, U S Production and Sales.*

•

Sivert N Glarum has joined the staff of Southern Research Institute, Birmingham, Ala, as assistant head of the Applied Chemistry Division. He will be concerned with research on chemical specialties and especially with textile and plastics chemicals. Dr Glarum was formerly chief chemist with Ciba Co Inc, Fair Lawn, NJ.

•

George E Shepherd has been appointed manager in charge of a newly established sales district for General Electric's Silicone Products Department. Designated as the New England District, this area has responsibility for the sale of General Electric silicone products in New England and upstate New York. District headquarters will be located at 145 North Beacon St, Boston 35, Mass.

Mr Shepherd joined General Electric's Silicone Products Department in 1950, most recently specializing in the sale of G-E silicones to the textile industry. He will be located at district headquarters in Boston.

Miller

Wica Chemicals, Inc has appointed *William H Miller* as national sales-service manager for its Wicaloid compounded latexes. Mr Miller will be headquartered at Charlotte, NC.

As manager of latex sales and service, Mr Miller will guide Wica's latex plant expansion and be active in further streamlining of the customer service latex program.

Mr Miller's responsibilities at Wica culminate seven years in sales latex compounds, specialty polymers and adhesives. His experience includes direct promotion for the benefit of intermediate consumers, distributors and ultimate consumers.

•

Klein

David X Klein, technical director of Heyden Chemical Div, Heyden Newport Chemical Corp, has been appointed a divisional vice president.

Mr Klein, technical director for the recently formed division since June 1959, has been responsible for the division's expansion and new products program. He was formerly manager of research at the company's Garfield, NJ laboratories.

•

C E Gibson has been promoted to regional sales supervisor for the Southeastern states for Dow Corning Corp. Mr Gibson will continue to work from Greensboro, NC, specializing in sales to the textile, paper, and leather industries in the entire area served by the Atlanta regional office, and he will supervise sales of all Dow Corning products in the Greensboro area. In addition, Gibson will serve in a liaison capacity with the new Technical Service Laboratory being built in Greensboro.

Fragala

The appointment of *S M Fragala* as plant manager has been announced by Putnam Chemical Corp, Beacon, NY. In his new duties, Mr Fragala will be responsible for all production at Putnam's Beacon plant.

•

New personnel with Southern Dyestuff Co, division of America-Marietta Co, include *Milton C Schroeder*, *Robert F Morris*, and *William C Robinson.*

Dr Schroeder joined Sodyeco in September 1959 in the Development Department. He formerly held the position of chemical engineer with Battelle Memorial Institute.

Mr Morris also joined Sodyeco in September. As a sales representative he is covering his territory out of Greensboro, NC, where he is associated with Sodyeco's *Clarence F Gibson.*

Mr Robinson, formerly employed Fiber Co, entered the Sodyeco training program in August.

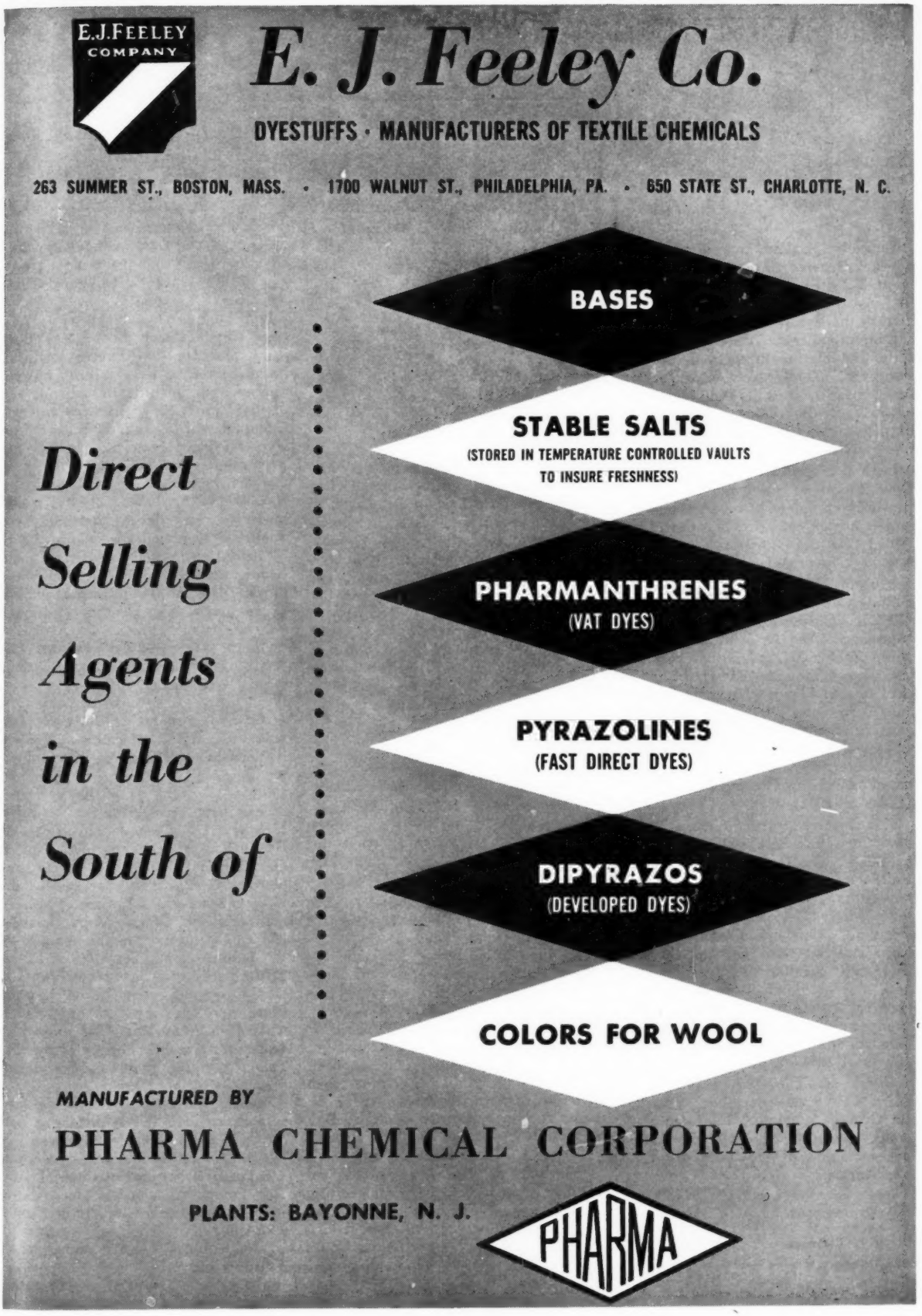
•

R Lindley Murray was honored Dec 15 by officials of Hooker Chemical Corporation at a dinner in Niagara Falls, NY, marking his retirement from active management in the company after more than forty-three years of association. He will, however continue as chairman of the board until the next annual directors' meeting on March 9.

Held at Hotel Niagara, the dinner was attended by approximately one hundred corporate and division officers, plant managers, and other executive personnel from various company operations in all parts of the United States as well as Canada.

R Wolcott Hooker, master of ceremonies and a senior vice president, told of his long and happy association with Mr Murray and briefly outlined the company's growth under his leadership.

Other speakers were *Thomas E Moffitt*, company president and chief executive officer, and *Bjarne Klaussen*, a former company president until his retirement in 1957.


E.J.FEELEY COMPANY
E. J. Feeley Co.
DYESTUFFS · MANUFACTURERS OF TEXTILE CHEMICALS
263 SUMMER ST., BOSTON, MASS. · 1700 WALNUT ST., PHILADELPHIA, PA. · 650 STATE ST., CHARLOTTE, N. C.
Direct Selling Agents in the South of
BASES
STABLE SALTS
(STORED IN TEMPERATURE CONTROLLED VAULTS TO INSURE FRESHNESS)
PHARMANTHRENES
(VAT DYES)
PYRAZOLINES
(FAST DIRECT DYES)
DIPYRAZOS
(DEVELOPED DYES)
COLORS FOR WOOL
MANUFACTURED BY
PHARMA CHEMICAL CORPORATION
PLANTS: BAYONNE, N. J.
PHARMA

• NAMES IN THE NEWS •

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E.J.FEELEY COMPANY

E. J. Feeley Co.

DYESTUFFS · MANUFACTURERS OF TEXTILE CHEMICALS

263 SUMMER ST., BOSTON, MASS. · 1700 WALNUT ST., PHILADELPHIA, PA. · 650 STATE ST., CHARLOTTE, N. C.

Direct Selling Agents in the South of

BASES

STABLE SALTS
(STORED IN TEMPERATURE CONTROLLED VAULTS TO INSURE FRESHNESS)

PHARMANTHRENES
(VAT DYES)

PYRAZOLINES
(FAST DIRECT DYES)

DIPYRAZOS
(DEVELOPED DYES)

COLORS FOR WOOL

MANUFACTURED BY

PHARMA CHEMICAL CORPORATION

PLANTS: BAYONNE, N. J.

PHARMA

Baker

Samuel G Baker, general manager of the Organic Chemicals Department, E I du Pont de Nemours & Co, Inc, last month was re-elected president of the Synthetic Organic Chemical Manufacturers Association at its 38th annual meeting, held at the Roosevelt Hotel, New York. The Association represents manufacturers of 90% of the domestic production of commercially marketed synthetic organic chemicals.

Carl A Gerstacker, vice president, Dow Chemical Co, was re-elected first vice president of the Association, and *Chester M Brown*, president, Allied Chemical Corp, was re-elected second vice president.

Norman C Babcock, vice president, Union Carbide Olefins Co, Union Carbide Corporation, was elected treasurer of the Association for 1960, while *Robert M Aude*, vice president and general manager, Heyden Chemical Division, Heyden Newport Chemical Corp, and *Arthur P Kroeger* assistant general manager, Organic Chemical Division, Monsanto Chemical Company, were elected new members of the Board of Governors (Class of 1962).

J R Frorer, a director, Atlas Powder Co, and *Richard Kithil*, vice president, The Carwin Co, will continue as members of the board of governors (Class of 1960). *C Kenneth Egeler*, Eastern manager of the Pigment, Color and Chemical Division, The Sherwin-Williams Co, and *Thomas C Keeling Jr*, vice president and general manager of the Chemicals & Dyestuffs Division, Koppers Company, Inc, will continue as members of the board of Governors (Class of 1961).

Elvin H Killheffer and *August Merz*, past presidents of the Synthetic Organic Chemical Manufacturers Association, were re-elected honorary members of the board for one-year terms.

●

Sidney M Edelstein, president, Dexter Chemical Corp, and chairman of AATCC's Archives Committee, has been elected a Fellow of the Society of Dyers and Colourists.

Merrill

Storesund

Babiarz

Bryant Chemical Corp has announced the appointment of *Arthur C Merrill Jr* as director in charge of its development and research laboratory now located at the North Quincy, Mass, plant. Mr Merrill, who succeeds the late *Lester C Conner*, was formerly with Arnold, Hoffman & Co, Inc at Providence, RI.

Millard S Storesund has joined Bryant Chemical as plant production manager. He will be assisted by *Richard J Babiarz*. Both men were formerly with Olin Mathieson.

●

McGraw

Ralph O McGraw Jr has been appointed district manager for the Mid-West territory of the Onyx Oil & Chemical Co, Jersey City 2, NJ.

In his new position, Mr McGraw will be in charge of Onyx's sales and service office at 140 North Dearborn St, Chicago 2, Ill. For the past five years, Mr McGraw has been sales representative in Indiana, Illinois and Wisconsin.

●

Election of *Horace C Jones* of Philadelphia to be vice president and treasurer of James Lees and Sons Co, carpet manufacturer of Bridgeport, Pa, has been announced. Mr Jones joined Lees in 1938, was made assistant treasurer the same year, and treasurer and director in 1946.

Edelman

Louis A Edelman has been appointed advertising and promotion manager of the Warwick Chemical Division, Sun Chemical Corp.

Mr Edelman has been with Warwick Chemical for three years, during which time he was a technical sales representative calling on the dyeing and finishing industry in the metropolitan New York area. Mr Edelman will be managing an extensive program, both advertising and promotion, to manufacturing and converting trades.

●

Walter Sullivan, in charge of the woolen technical department of Metro-Atlantic, Inc, recently returned from a month's trip to Europe where he visited some of the largest woolen processing plants. His trip was mainly concerned with an exchange of technical know-how on various methods of dyeing and finishing various qualities of fabrics.

●

Six appointments in the Sales Department of Solvay Process Division, Allied Chemical Corp, became effective January 1. *Fred P Boehm* and *Charles E Varn* have been named assistant directors of sales.

Robert E Clagett succeeds Mr *Boehm* as Pittsburgh sales branch manager and *G Richard Barclay* replaces Mr Varn as manager of the New Orleans sales branch.

In addition, *Jerome L Hochenedel* has moved up from assistant manager to manager of Solvay's Houston, Texas sales branch, succeeding *S O Taylor*, who has retired after 33 years of service with the company.

Richard A Marshall has moved up from assistant to manager of the Organic Chemicals Section, a post formerly held by Mr Barclay.

Messrs Boehm, Varn and Marshall will make their headquarters at Solvay's New York office, 61 Broadway.

L R Croce, Philadelphia salesman for Allied Chemical's National Aniline Division, is instructing evening students at the Philadelphia Textile Institute.

The subject of his course, held twice weekly, is "Fiber Preparation and Dyeing of Natural and Synthetic Fibers."

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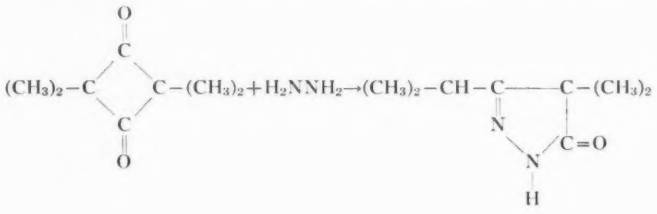
Commercial Process for Cyclobutane Derivatives

A commercial process for the manufacture of tetramethyl-1, 3-cyclobutanedione and its reduction product 2,2,4,4-tetramethyl-1, 3-cyclobutanediol, reportedly promises to open up an entirely new field of chemical products. These two cyclobutane compounds, now available in development quantities from Eastman Chemical Products, Inc, subsidiary of Eastman Kodak Company, result from a new process developed by Eastman chemists for the preparation of dimethyl ketene, which readily dimerizes to give the tetramethyl dione. The corresponding diol is then easily obtained by catalytic hydrogenation. Although the process details for preparation of the ketene have not been revealed pending patent approvals, the chemical route originates with isobutyraldehyde, available from Eastman's Longview, Texas, oxo facilities.

The cyclobutane derivatives are not new to alicyclic chemists, but until now a practical and economically feasible production method had not been developed. With a readily available supply source, the reactions typical acyclic ketones and secondary glycols will have new significance for commercial research and development, it is claimed.

Eastman chemists find that the dione reacts readily to form the oxime, cyanohydrin, and other typical reactions of diketones. Of special interest are reactions with certain carbonyl group reagents which result in the formation of heterocyclic derivatives.



These compounds have potential use as dye intermediates.

The cyclobutanediol derivatives of greatest current interest are the esters and polyesters. They reportedly have shown exceptional thermal and hydrolytic stability in preliminary studies. For example, the di-2-ethylhexoate ester required 48 hours for complete hydrolysis in boiling alcoholic 0.5N sodium hydroxide. By comparison the 2-ethylhexoate ester of another commercially available glycol was completely hydrolyzed in seven hours.

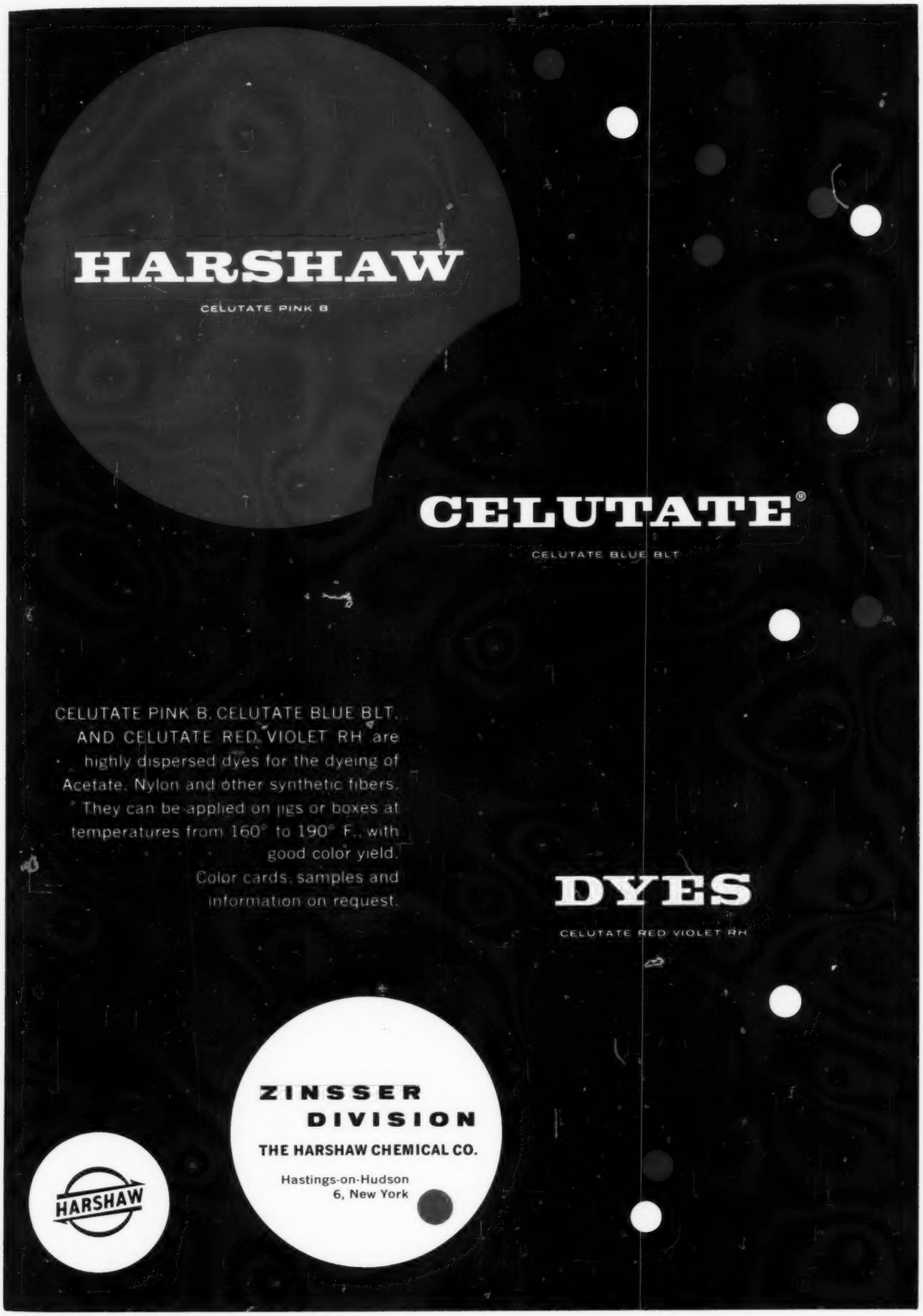
Both compounds are white crystalline solids. The dione melts at 115-116°C, and the diol at 125-135°C. Research samples of these two new development products and further technical information may be obtained upon request to the company at Kingsport, Tenn.

Moretex the Rx of Chemicals

Like a doctor's prescription, Moretex Chemicals are held to rigid standards of purity. Laboratory research is constantly seeking ways in which to improve existing formulae and develop new ones for the fast growing array of fibers.

APPLICATION	PRODUCT NAME	CHEMICAL NATURE
ANTISLIP	MOROPOL EMULSIONS	EMULSIONS OF POLYETHYLENE
	BINDER X	CHITOSAN ACETATE
ANTICROCK	MOROPOL X-105	AQUEOUS POLYETHYLENE EMULSION
BLEACHING ASSISTANT	SULFONATED CASTOR OIL	50% AND 75% SULFONATED CASTOR OIL
CHELATING AGENT (Fe, Al)	MORENE S	POLYHYDROXY CARBOHYDRATE
CHELATING AGENT (General)	MORENE 30	SODIUM SALT OF ETHYLENE DIAMINE TETRA ACETIC ACID
EMULSIFIER	MOROSOL SL	POLYOXYETHYLENE SORBITAN STEARATE
DYE FIXATIVE	MOREPEL RW	AQUEOUS DISPERSION OF PARAFFIN & ALUMINUM ACETATE
FINISHES		
BODYING AGENT	MOROLUBE H61	ANIONIC FATTY ESTER EMULSION
CRUSH RESISTANT (Durable)	MOROPOL 700 600	AQUEOUS POLYETHYLENE EMULSION
EMBOSSING & GLAZING	MOROPOL 700	AQUEOUS NONIONIC POLYETHYLENE EMULSION
SEWABILITY FINISH	MOROLUBE GW	AQUEOUS NONIONIC HYDROCARBON EMULSION
SHRINKAGE CONTROL	KYLAN	DEACETYLATED CHITIN
SOFTENERS		
CATIONIC	MORAMINE C	FATTY ACID AMIDE—ACETIC ACID SALT
KNITTING	MOROPOL 600	NONIONIC POLYETHYLENE EMULSION
NAPPING		
SOFT	MORAMINE NS	MIXED FATTY SULFONATES & AMIDES
FULL BODY	MOROFIN 61	ANIONIC DISPERSION OF FATTY ACID ESTERS
SCROOP	MOROFIN AD	ANIONIC DISPERSION OF FATTY ACID ESTERS
NON SOIL RETENTIVE (Durable)	MOROPOL 762	DISPERSION OF GLYCERIDIC EPOXYDIZED OIL
WASH & WEAR (Durable)	MOROPOL 700, 762	NONIONIC EMULSION OF DURABLE RESIN PLASTICIZERS
LUBRICANT (Yarn)	MOROLUBE BA	NONIONIC LIQUID EMULSION OF SATURATED HYDROCARBON
PENETRANTS		
DYEING	MOROWET DC70, DC25	SODIUM SALTS OF DIOCTYL SULFOSUCCINATE
MERCERIZING	MERCERIZER ASS'T.	CRESYLIC BASED PENETRANT
REWETTING	MOROWET LF	SULFONATED BUTYL OLEATE (Sodium Salt)
PLASTICIZER & DISPERSANT	MOROSOL 4L	PEG 400 MONOLAURATE
SIZING		
COTTON	MORETEX 70	MIXTURE OF WATER INSOLUBLE
SYNTHETICS	MORETEX 85	MIXTURE OF WATER DISPERSIBLE FATTY ACID AND FATTY GLYCERIDE DERIVATIVES
WATER REPELLENT	MOREPEL RW	AQUEOUS DISPERSION OF PARAFFIN AND ALUMINUM ACETATE

MORETEX ESTABLISHED 1908 *Chemical Products,* INC. **Spartanburg, S.C.**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ABSTRACTS

Bonded Materials of Tomorrow

Anon, *Man-made Textiles 35, 46-7, 91, Feb, 1959*

It is convenient to distinguish three classes of bonded materials. The entire family is easily divided, on the basis of end-use, into nonrigid, semirigid and rigid structures.

The nonrigid group comprises a large class of fabrics intended mainly for textile purposes. In the lighter weights, attempts are being made with some success to introduce such fabrics into markets at present held by conventionally produced woven or knitted structures.

The semirigid group includes artificial leathers and car upholstery fabrics, where the base is a web of fibers which has been surfaced with a plasticized resin or synthetic rubber, the fabric being bonded by pressure and heat and a patterned surface imparted during the process. This class also includes the heavier dress fabrics, felts and a whole range of semistiffened products from shirt cuffs and collars to interlinings for suits and coats, paddings, pocket linings and lapels.

The rigid group is made up of structures which are not designed as textile materials, the chief property being one of rigidity in both directions, a characteristic not wholly desirable in woven and knitted textiles. Such materials are usually heavily treated with resin, but are nevertheless based on a fibrous structure.

For the nonrigid type the starting material is usually a web, or webs of cotton or rayon staple which have been laid crosswise over each other. The individual fibers are then joined together by a material which adheres to them, such as viscose or a dilute solution of cellulose acetate. The whole is then treated in the case of viscose with acid, bleached and washed, or when a dope of cellulose acetate is used, dried, and the whole pressed together and bonded by heat. Viscose or a solution of cellulose xanthate gives a stiffer finish which is less flexible than one in which the bonding agent is an emulsion of polyvinyl acetate or compositions based on butadiene.

A second way of producing the primary web, as opposed to a layer or layers of carded web, is to use an air-laying method in which the cut fibers are spread over an area in an equal distribution. This single homogeneous layer containing fibers with a random distribution is said to be more costly, but it provides a fabric without the disadvantages of some carded webs, of tensile weakness in one direction. This random web is next treated with monomeric emulsions of latices (eg, PVA or the acrylics), or impregnated with viscose and finally finished as for a carded web.

A later development is to include in both types of web a proportion of thermoplastic fibers and to bond them together by heat. This allows advantage to be taken of the thermoplastic component. Such mixtures can be permanently pleated and the resulting fabric heat-set.

The author gives details of several recent British patents which describe various improvements on the above processes.

•

Polypropylene Fibers Introduced to Cotton, Linen and Rayon Fields

Anon, *Can Textile J 76, 66, Oct 16, 1959*

Synthetic fibers made from 100% polypropylene, and blends of these with wool and other fibers, have been developed at the Textile Research Center of Montecatini, located at Terni, Italy.

These new staple fibers can be woven into fabrics which have some properties far superior to those of pure cotton, according to the author. They can be spun-dyed in an extensive range of colors or dyed directly, even when blended with other fibers such as cotton, rayon and linen.

Some of the important characteristics of the new fiber mentioned by the author are a very low sp gr (0.91), high tensile strength, good resistance to abrasion, high resistance to acids and alkalis, absence of static electricity effects, and no pilling difficulty.

Some of the uses of the polypropylene fiber and its blends are in car robes, sweaters, socks and suitings.

In addition to staple, the manufacturer is producing both multifilament yarn for use in the traditional silk field and monofilament for various industrial applications.

It is expected that production of these new fibers will soon reach 30 million pounds annually.

•

New Developments in Cibacron Dyestuffs

Bardt, K J, *Can Textile J 76, 33-7, Oct 30, 1959*

Reactive dyes are unique in that they form a chemical bond with the fiber. In this paper only reactive dyes of the Cibacron type are discussed, namely halogenated cyanuric compounds containing one reactive chlorine atom. These dyes form an ester linkage with cellulose when applied in such a way that they align themselves by substantivity, in an aqueous medium, to cellulose, followed by reaction under the influence of increased temperature and alkaline conditions.

Cellulosic fabrics are generally dyed by padding processes. In dyeing cotton, an immersion time in the pad of less than 1.5 seconds is satisfactory. When padding rayon, however, a longer immersion time is required. In general, the affinity for the cellulose fiber is decreased by addition of urea, also by high pH and temperature, while it is increased by addition of electrolytes.

In drying Cibacron dyes on cellulosics, the dye molecules must approach very closely to the cellulose molecule in order to react (by forming an oxygen bridge with the hydroxyl group of the cellulose). The ideal dryer is one which has a high temperature and very high humidity. The author recommends superheated steam as the drying medium.

When applying a dye by the pad-jig method, it is beneficial to run the goods for a few ends in a saturated salt solution before adding alkali for fixation. A rather low pH (eg, 7.0-7.5) is recommended.

The author also furnishes details for package dyeing. In any dyeing process on cellulosic fibers, he says, subsequent soaping at the boil, to remove any unfixed dye, is of the utmost importance.

For printing on cellulosics an emulsion system is recommended. This has been widely used and is described in detail.

With wool, by contrast, Cibacron dyes form a covalent linkage which is unique for reactive dyes, according to the author. A reaction with wool takes place by having the dye form an imino linkage between the triazine ring of the dye and a side chain of the wool keratin *via* an NH bridge. This reaction occurs under moderately acid conditions and temperatures around 212°F.

Cibacron dyes are applied to wool by a method employing Neovadine AN. The dye is first attracted to the Neovadine, apparently, and the Neovadine in turn attaches itself to the wool fibers. After one hour at the boil, all dyestuff is evenly deposited throughout the fibers, while the Neo-

vadine becomes devoid of dye. A hot treatment with ammonia will remove any unreacted dye.

●

Fiber Swelling Affects Degree of Cross-linking (of Cotton Fibers)

Reeves, W A, Perkins, R M and Chance, L H, *Textile World 109, 87, 89, Nov, 1959*

The wet and dry wrinkle resistance and wet and dry densities of cotton fabrics finished with resins and reactants vary according to the amount of fiber swelling at the time of the reaction. Fiber swelling in turn is dependent on the water present in the fiber and treating solution.

In the trials described by the authors all types of resins in common use were used in determining the effect of cross-linking on fiber behavior; but formaldehyde catalyzed with HCl was used as a basis for determining the effect of moisture content in the fiber at the time of reaction.

Formaldehyde forms a simple methylene bridge structure with cellulose that simplifies density determinations and estimation of actual cellulose-formaldehyde cross-linking.

Cross-linking tends to fix or stabilize a fiber in a given state of swelling; the stabilization is more effective when the cross-linking is done in nearly anhydrous systems.

Samples of cotton fabric were treated in solutions of formaldehyde carrying varying amounts of water and acetic acid. (Acetic acid is a relatively poor swelling agent for cotton.) The aqueous systems produced considerable swelling of the cotton before and after cross-linking, while the systems with large amounts of acetic acid inhibited fiber swelling.

The tests showed that the state of fiber swelling at the time of cross-linking had a tremendous effect on fiber structure and the physical properties of fabric made from the fibers. A high degree of fiber swelling produced wet wrinkle resistance but no dry wrinkle resistance. Relatively little swelling resulted in a fabric with excellent all-around wash-and-wear characteristics, whether drip or tumble dried. The more highly reacted fabrics also showed a higher wet density.

The degree of swelling at the time of cross-linking has permanent influence on the final state of openness in the fiber.

Fabrics treated with formaldehyde at various water concentrations show a marked difference in dyeability. All the fabrics tested for dyeability had 0.6% combined formaldehyde but were reacted in systems containing various amounts of water. Fabrics cross-linked in systems containing 68% or more water dyed slightly darker than untreated control fabric. At 18% or less water there was considerable dye resist.

The conclusion drawn from these results is that, as the water content of the reaction system was decreased, cross-linking action reduced fiber pore size to the point of obstructing dye molecule entrance.

●

Finishing Triacetate Fabrics

Anon, *Man-made Textiles 36, 57-8, Oct, 1959*

"Tricel", British Celanese's triacetate fiber, has proved exceptionally adaptable, the author says, in blends with cotton, rayon and wool.

Blends with either rayon or cotton, containing at least two-thirds Tricel, have a satisfactory crease-resistance in pure finish. If the proportion of Tricel is lower, a resin treatment is required.

The manufacturers point out that it is necessary to use low-molecular-weight resin condensates, in order to obtain penetration of the fibers. Rayon and cotton readily absorb resins from aqueous solutions, but Tricel, being more hydrophobic, absorbs little resin, the greater part being deposited on the surface. For this reason, the resin content of the fabric as a whole should be much less than for a 100 percent rayon fabric.

The application of crease-resist resin finishes to Tricel blends follows the usual pattern for fabrics containing acetate. Since many cloths are intended for subsequent pleating, condensation of the resin must be complete, and the curing temperature must be kept as low as practicable. A thorough washing-off is essential.

Steam pleating is the more commonly used of the two methods for producing pleats. Steaming for 30 minutes at 15-20 psi should be adequate. Higher pressures and longer steaming may cause shade changes.

Fabrics containing Tricel blended with wool should be processed at a lower temperature (10 psi) for 20 minutes.

In machine pleating, minimum times and temperatures are advisable, to avoid shade changes and glazing. Tricel light filament fabrics require only 10-15 seconds at 165-175°C, but blends with rayon or cotton require 10-20 seconds at 185-190°C, and blends with nylon or Terylene will need 10-20 seconds at 190-200°C. Tricel/wool blends can be machine-pleated at not over 175°C for 10 seconds, but this process may lead to strength loss and discoloration.

●

Jigger Studies. I. The Watering of Acetate Poult Fabrics: Cause and Prevention

France, E, *J Soc Dyers Col 75, 477-83, Oct, 1959*

The fault of watering is most frequently encountered in densely constructed cellulose acetate fabrics woven from low-twist continuous-filament yarns, eg, linings, taffetas, grosgrains and some satins. The development of the characteristic handle and appearance associated with the above types of fabric, and their tendency to form sharp creases rather than rounded folds, necessitates their treatment in open-width dyeing machines. Since the fault involves an irreversible deformation of the fabric, it can rarely be corrected.

The attractiveness of these usually high-quality fabrics dyed and finished on the jigger is often impaired by the appearance of diffuse areas which reflect light differently. These areas, which shimmer or glisten to a varying degree, vary in size and contour.

Various explanations have been made from time to time explain the origin and cause of this fault, but according to the author there is no agreed opinion as to the mechanism of watering; but the application of undue tension or pressure to the fabric in roll form is the basis of most of the explanations advanced.

Details are given of an extensive investigation into the problem. It was demonstrated beyond reasonable doubt that watering occurs at the beginning of the first wetting-out run, and that the moiré pattern so produced is not changed during subsequent scouring and dyeing operations. Watering is due to the generation of high pressures on the innermost layers of the roll by the tension in the fabric, due to its tendency to shrink for some minutes (depending on the temperature) after the first wetting. It would therefore appear desirable, the author suggests, to relax the fabric completely before batching for the first time. Unfortunately, however, methods based on this approach are impracticable for one reason or another.

Reduction in pressure by increasing roller diameter can decrease the interfabric pressure, but not completely eliminate it. However, in use, a method so based proved to be a practical compromise, giving reasonably smooth operation in the production of fabrics substantially free from watering.

●

PATENT DIGEST

PAUL WENGRAF

BLEACHING OF SYNTHETIC TEXTILES——— Permonosulfuric Acid Used

B,2

U S Pat 2,882,121 (Stevenson Dyers——Fell——April 14, 1959)

Synthetic linear polyamide fibers (nylon or Perlon) are known to have a yellowish-gray color which may sometimes be increased by heat seting or preboarding. Bleaching materials for cotton or wool, such as H_2O_2, sodium perborate or hypochlorites, are said to be unsuitable, even injurious to nylon, Orlon or other synthetic fibers.

It is reported that synthetic textiles can be bleached with a permonosulfuric acid solution and kept at pH 2.5 or less at room to boiling temperatures. Dilute solutions may require about 14 hours to effect the desired bleaching at room temperature, while from 80°C up to the boiling point a practical time of operation is from 15 to 20 minutes.

Example: A scoured, heat-set nylon fabric that still had a yellowish-gray hue was immersed for 14 hours at about 20°C into an aqueous bath containing seven g/l permonosulfuric acid. The bath was then brought to pH 0.6 with sulfuric acid plus 1.1 g/l hydrogen peroxide. The fabrics were found to have obtained the desired whitening effect, while tensile strength, abrasion resistance and other properties remained unimpaired.

According to this and three other examples, the bleaching results were the same when H_2O_2 was omitted.

Among the references cited by the Patent Office:

U S Pat 2,701,178 (Stevenson Dyers /1955): Wool is rendered shrinkproof by treatment with permonosulfuric acid. [Cf *Am Dyestuff Reptr 45*, 959 (1956)].

U S Pat 2,739,034 (Stevenson Dyers /1956): Wool may be shrinkproofed by an initial treatment with permonosulfuric acid or salts thereof, and a subsequent treatment with basic salts of sulfurous acid. [Cf *Am Dyestuff Reptr 46*, 22 (1957)].

U S Pat 2,720,441 (Du Pont/1955): Bleaching of polyacrylic fibers calls for a treatment with organic peracids, such as performic or peracetic acid. Permonosulfuric acid is not mentioned in this specification. [Cf *Am Dyestuff Report 45*, 960 (1956)].

•

PIGMENT BINDERS——— Copolymerisates of Unsaturated Esters with Ureidovinylethers

D,2,07

U S Pat 2,883,304 (Rohm & Haas——Kine, Nuessle ——April 21, 1959)

The use of aqueous starch thickeners as pigment binders is said to have several disadvantages, eg, stiffening of the fabrics, yellowing on aging, and practically no dyestuff fixing effect after a washing. It has been suggested that synthetic linear polymers of the vinyl or acrylic types be used as binders for pigments, but these polymers have insufficient resistance to laundering because they become plastic at normal washing temperatures, and tend to exhibit plastic flow under these conditions.

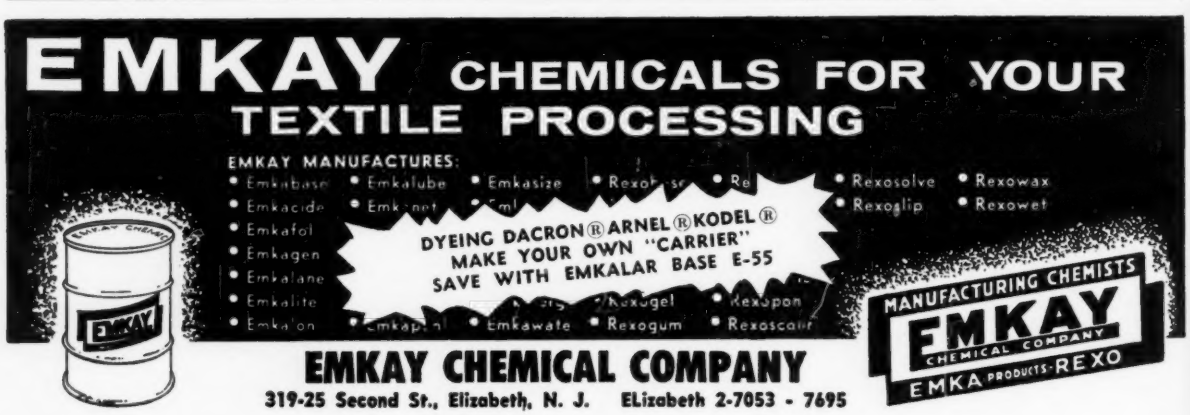
The pigment-binding composition protected by U S Pat 2,883,304 consists of copolymers of a) a vinyl-ureido compound (one to 15%), such as vinyl oxyethyl urea: $CH_2 = CH - O - C_2H_4NH.CO.NH_2$; and b) other monomers (85-99%), such as acrylamides, acrylic esters, vinyl compounds, etc. Copolymers of ureido-vinyl ethers (a) with alkylacrylates (b) in which the alkyl contains one to eight C atoms are preferred. (Cf col 3, lines 30-37). The monomers are copolymerized in aqueous emulsions that contain no organic solvents, and blended with the pigment at a ratio 1:1. Heat drying of the prints (or dyeings) is assumed to crosslink and insolubilize the polymeric chains; a small amount of an acid catalyst may be added to accelerate crosslinking through the ureido groups. Auxiliary crosslinking agents, such as aldehydes, have been found to enhance the resistance to washing.

Example: Cotton fabrics were padded in a copolymer binding emulsion consisting of 90% butylacrylate and 10% ureido isobutyl vinylether, $CH_2 = CH.O.CH_2 - C(CH_3)_2 - NH-CONH_2$; the emulsifying agent was polyethoxylated tert-octylphenol; and the pigment, a phthalocyanine blue. The fabrics were then dried at 240°F and cured for 10 minutes at 300°C. Good resistance to washing is reported.

Among the references cited by the Patent Office:

U S Pat 2,689,844 (Rohm & Haas / 1954) describes the preparation of the methylolated ureido alkyl vinyl ethers called for in U S Pat 2,883,304.

U S Pat 2,719,832 (BASF / 1955): Combinations of acrylic derivatives (esters, amides, etc) polymerizable with hardenable precondensates of the thermosetting type, such as methylolated ureas, and also ethers of methylol compounds may be used for pigment fixing coating, and so on. [Cf *Am Dyestuff Reptr 45*, 984 (6195)].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